

Part 125—Certification and Operations: Airplanes Having a Seating Capacity of 20 or More Passengers or a Maximum Payload Capacity of 6,000 Pounds or Greater

This change incorporates Amendment 125-30, Revisions to Digital Flight Data Recorder Rules, adopted July 9 and effective August 18, 1997. This amendment adds § 125.226 and Appendix E.

Bold brackets appear around the most recently revised or added material. The amendment number and effective date of these changes appear in bold brackets at the end of each affected section.

Page Control Chart

| Remove Pages | Dated | Insert Pages | Dated |
|---------------------|--------------|---------------------|--------------|
| P-405 | Ch. 11 | P-405 through P-429 | Ch. 12 |
| Subpart F | Ch. 8 | Subpart F | Ch. 12 |
| | | Appendix E | Ch. 12 |

Suggest filing this transmittal at the beginning of the FAR. It will provide a method for determining that all changes have been received as listed in the current edition of AC 00-44, Status of Federal Aviation Regulations, and a check for determining if the FAR contains the proper pages.

The information collection requirements in the amendment to §§ 121.579, 125.329, and 135.93 have previously been approved by the Office of Management and Budget (OMB) under the provisions of the Paperwork Reduction Act of 1980 (44 U.S.C. 3501 *et seq.*) and have been assigned OMB Control Number 2120-0008.

Economic Assessment

The FAA has determined that this rulemaking is not a significant rulemaking action as defined by Executive Order 12866, and therefore no assessment is required. In accordance with Department of Transportation Policies and Procedures (44 FR 11034; February 26, 1979) when the impact of a regulation will be minimal if adopted, a full regulatory evaluation does not need to be prepared. The following discussion provides an economic assessment of the proposal's anticipated costs and benefits.

Costs

The amendment will allow air carriers and commercial operators to seek authorization for the use of autopilot systems during the takeoff phase of flight. Because the decision whether to seek authorization for the use of autopilot is optional and voluntary, the amendment will not impose any additional costs on certificate holders that operate under parts 121, 125, or 135.

Benefits

This amendment will have positive effects on the safety of air operations. As with any change to operations specifications, the FAA reserves the right to determine whether suggested revisions to an air carrier's operations specifications meet the various criteria and guidelines that will ensure that the current level of safety is met or exceeded.

The use of the autopilot system below 500 feet AGL will enable the pilot to monitor the performance of the aircraft while performing other safety-related functions, such as scanning the outside area for other aircraft. Since less time is spent manipulating the controls, the use of the autopilot also enables the flightcrew to more readily identify any deviations from expected aircraft performance thus increasing the pilot's opportunity to quickly respond to any aircraft malfunctions. Increasing the pilot's opportunity to scan the area outside the aircraft for other airborne traffic, to detect aircraft malfunctions, and to respond more quickly to problems will increase the level of safety.

International Trade Impact Analysis

The FAA has determined that the amendments to parts 121, 125, and 135 will not have a significant impact on international trade. The amendments are expected to have no negative impact on trade opportunities for U.S. firms doing business overseas or foreign firms doing business in the United States.

International Civil Aviation Organization and Joint Aviation Regulations

In keeping with U.S. obligations under the Convention on International Civil Aviation, it is FAA policy to comply with ICAO Standards and Recommended Practices (SARP) to the maximum extent practicable. In reviewing the SARP for air carrier operations and JAR-OPS 1, the FAA finds that there is not a comparable rule under either ICAO standards or the JAR.

Regulatory Flexibility Determination

Congress enacted the Regulatory Flexibility Act (RFA) of 1980 (Pub. L. 96-354) to ensure that small entities are not unnecessarily and disproportionately burdened by government regulations. The RFA requires agencies to review rules that may have a significant impact on a substantial number of small entities. This amendment will impose no additional costs on air carriers; therefore, it will not have a significant economic impact on small business entities.

is not a significant rulemaking action under Executive Order 12866. This amendment is also considered nonsignificant under Department of Transportation Regulatory Policies and Procedures (44 FR 11034; February 26, 1979). In addition, the FAA certifies that this amendment will not have a significant economic impact, positive or negative, on a substantial number of small entities under the criteria of the RFA.

The Amendment

In consideration of the foregoing, the Federal Aviation Administration amends parts 121, 125, and 135 of the Federal Aviation Regulations (14 CFR parts 121, 125, and 135) effective June 20, 1997.

The authority citation for part 125 continues to read as follows:

Authority: 49 U.S.C. 106(g), 40113, 44701-44702, 44705, 44710-44711, 44713, 44716-44717, 44722.

Amendment 125-30

Revisions to Digital Flight Data Recorder Rules

Adopted: July 9, 1997

Effective: August 18, 1997

(Published in 62 FR 38362, July 17, 1997)

SUMMARY: This document revises and updates the Federal Aviation Regulations to require that certain airplanes be equipped to accommodate additional digital flight data recorder (DFDR) parameters. These revisions follow a series of safety recommendations issued by the National Transportation Safety Board (NTSB), and the Federal Aviation Administration's (FAA) decision that the DFDR rules should be revised to upgrade recorder capabilities in most transport airplanes. These revisions will require additional information to be collected to enable more thorough accident or incident investigation and to enable industry to predict certain trends and make necessary modifications before an accident or incident occurs.

DATES: *Effective date:* August 18, 1997. Comments on the Paperwork Reduction Act issues presented in this document must be received by September 15, 1997.

ADDRESSES: Comments on this notice should be mailed, in triplicate to: Federal Aviation Administration, Office of Chief Counsel, Attention: Rules Docket (AGC-200), Docket No. 28109, 800 Independence Avenue SW., Washington, DC 20591. Comments delivered must be marked Docket No. 28109. Comments may also be submitted electronically to the following Internet address: 9-nprm-cmts@faa.dot.gov. Comments may be examined in Room 915G weekdays, except on Federal holidays, between 8:30 a.m. and 5 p.m.

FOR FURTHER INFORMATION CONTACT: Gary E. Davis, Air Carrier Operations Branch (AFS-220), Flight Standards Service, Federal Aviation Administration, 800 Independence Avenue, SW., Washington, DC 20591; telephone (202) 267-3714.

SUPPLEMENTARY INFORMATION:

Background

Statement of the Problem

The NTSB submitted recommendations to the FAA to require the recordation of additional parameters on certain flight data recorders. These recommendations were submitted in response to accidents involving two Boeing 737 aircraft that were operated by two different air carriers. Both airplanes were equipped with flight data recorders (FDR's), but in neither case did the FDR provide sufficient information about

On February 22, 1995, the NTSB submitted to the FAA recommendations A-95-25, A-95-26, and A-95-27, which recommended that the FAA require upgrades of the flight data recorders installed on certain airplanes to record certain additional parameters not required by the current regulations.

The following recommendations were submitted by the NTSB to the Federal Aviation Administration:

I. Require that each Boeing 737 airplane operated under 14 CFR part 121 or 125 be equipped, by December 31, 1995, with a flight data recorder system that records, as a minimum, the parameters required by current regulations applicable to that airplane plus the following parameters: lateral acceleration, flight control inputs for pitch, roll, and yaw, and primary flight control surface positions for pitch, roll, and yaw. (Classified as Class I, Urgent Action) (Recommendation No. A-95-25)

II. Amend, by December 31, 1995, 14 CFR §§ 121.343, 125.225, and 135.152 to require that Boeing 727 airplanes, Lockheed L-1011 airplanes, and all transport category airplanes operated under 14 CFR parts 121, 125, or 135 whose type certificates apply to airplanes still in production, be equipped to record on a flight data recorder system, as a minimum, the parameters listed in "Proposed Minimum FDR Parameter Requirements for Airplanes in Service" plus any other parameters required by current regulations applicable to each individual airplane. Specify that the airplanes be so equipped by January 1, 1998, or by the later date when they meet Stage 3 noise requirements but, regardless of Stage 3 compliance status, no later than December 31, 1999. (Classified as Class II, Priority Action) (Recommendation No. A-95-26)

III. Amend, by December 31, 1995, 14 CFR 121.343, 125.225, and 135.152 to require that all airplanes operated under 14 CFR parts 121, 125, or 135, having 10 or more seats, and for which an original airworthiness certificate is received after December 31, 1996, record the parameters listed in "Proposed FDR Enhancements for Newly Manufactured Airplanes" on a flight data recorder having at least a 25-hour recording capacity. (Classified as Class II, Priority Action) (Recommendation No. A-95-27).

FAA Response to the NTSB Recommendations

On March 14, 1995, the FAA published in the *Federal Register* a notice of a public hearing, and solicited public comment concerning the NTSB recommendations. On April 20, 1995, the public hearing was held in Washington D.C. Eight speakers from the aviation community made presentations. Copies of the presentations have been placed in the docket for this rulemaking.

After considering the information obtained through the public forum, the FAA responded to the NTSB recommendations. A summary of that response was published in Notice No. 96-7, and is summarized here:

In response to Safety Recommendation A-95-25, the FAA stated that it agrees that Boeing 737 airplanes that operate under 14 CFR part 121 or 125 should be equipped with flight data recorders that include, as a minimum, the parameters referenced in this safety recommendation. This proposed rule would require all Boeing 737 airplanes as well as certain other airplanes operated under 14 CFR parts 121, 125, or 135 having 10 or more seats to be equipped to record the parameters that were specified by the NTSB.

The FAA received enough valid information from the public to determine that the schedule for retrofit completion by December 31, 1995, could not be met. The proposed date would have imposed an extremely aggressive retrofit schedule that, if it were physically possible, would have resulted in substantial airplane groundings and very high associated costs. Furthermore, if operators had been required to retrofit all Boeing 737 airplanes before the end of 1995, each of these airplanes might have had to undergo a second retrofit to meet the expanded requirements that were proposed in response to NTSB Recommendations A-95-26 and -27.

the presentations, the FAA determined that it would be beneficial to have aviation industry personnel assist in any related rulemaking efforts. On June 27, 1995, the FAA published a notice in the *Federal Register* that the Aviation Rulemaking Advisory Committee (ARAC) established the Flight Data Recorder Working Group (60 FR 33247), which included members representing the Air Transport Association, Aerospace Industries Association of America, General Aviation Manufacturers Association, Regional Airline Association, Air Line Pilots Association, and the FAA. The NTSB was invited to participate in working group efforts in an advisory capacity. The working group's task was to recommend to ARAC rulemaking proposals or other alternatives that would satisfactorily address the NTSB recommendations. The ARAC could then make one or more recommendations to the FAA, and the FAA would determine whether to issue a proposal based on the ARAC recommendation.

The DFDR Working Group met over the course of several months. While many of the issues concerning flight data recorder upgrades were settled, no formal recommendation was forwarded to the FAA by the ARAC. A full discussion of the issues considered by the working group was included in Notice 96-7.

NPRM No. 96-7

On July 16, 1996, the FAA published an NPRM addressing revisions to digital flight data recorder rules and solicited public comment to the proposed amendments. The proposals were based on meetings attended by FAA, ARAC, and NTSB personnel. Twenty-six commenters responded, each addressing multiple issues. Their comments have been placed in the docket. Although numbered comments in the docket indicate 28 commenters responded, several submittals were duplicates. Comments to the NPRM are discussed in detail in the "Discussion of Comments to the NPRM" section of this document.

Supplemental Notice of Proposed Rulemaking, SNPRM No. 96-7A

As a result of some comments received and further analysis within the FAA, the FAA determined that some issues not included in the NPRM, but related to the proposal, should have been included. These issues included: (1) Applicability of the requirements to airplanes placed on the operations specifications of a U.S. operator after a certain date; (2) a compliance date for certain aircraft that must be retrofitted with DFDR equipment as a result of a change in policy announced in Notice 96-7; (3) information regarding airplanes that should be exempted from the requirements proposed in Notice 96-7; and (4) a requirement to use a 25-hour recorder, which is the industry standard, rather than the 8-hour recorder currently required. Because three of the issues were not included in the initial proposal, and because the FAA needed more information to make a determination regarding all four of the issues, the agency published a supplemental proposal on December 10, 1996 (61 FR 65142), and solicited public comment. Six comments were received; they are discussed in detail in the "Discussion of Comments to the SNPRM" section in this document. After analysis of all comments received, the FAA has adopted final rule language that includes items proposed in the SNPRM.

Discussion of Comments to the NPRM

Flight Systems Engineering, Inc., comments on the requirement for recordation of lateral acceleration on airplanes with one or two engines. It states that to the best of its knowledge, the "trade-in" program to upgrade from dual to tri-axial accelerometers was considered, but is not currently available and it doubts it will ever be. The commenter estimates the cost of the tri-axial accelerometer to be \$3,000 per aircraft plus associated engineering and installation costs. The commenter believes that the accelerometer information can be obtained through analysis of other available data. In addition, the commenter states that to require a sampling rate of twice per second (rather than the current once per second) as proposed for certain parameters may generate costs to industry that the commenter does not consider to be cost beneficial.

FAA Response: The FAA acknowledges that this rule will place some economic burdens on operators. According to information received by the FAA, however, the \$3,000 per aircraft for a tri-axial accelerometer

FAA Response: The FAA appreciates the comment from Patriot; the FAA notes that the costs for modification of existing units presented by the commenter are approximately one third less than those presented by the operators for new units. Further discussion of other comments concerning the economic impact of this rule are contained in the Regulatory Evaluation section of this preamble.

AVRO International Aerospace comments that the proposed list of parameters appears to have been developed to address a specific type of airplane that has experienced a small number of accidents, and that the proposed list of parameters may not be the most appropriate for general application. AVRO also states that the European codes have been formalized for adoption through JAR Ops and that it considers the FAA's action to extend requirements beyond the EUROCAE ED-55 standards (ED-55) without a full consultation with JAA authorities to be contrary to the spirit of the JAR/FAR Harmonization program.

FAA Response: The FAA acknowledges that the requirements proposed in the NPRM could appear to have been developed to address a specific type of airplane, and expanded to merely include all airplanes. However, the parameters proposed to be recorded involve functions of all airplanes, and may provide data over a wide range of incidents and accidents. Accordingly, in response to the NTSB recommendation, the FAA has included all transport category airplanes in this rulemaking action. The FAA disagrees that extended U.S. requirements require full consultation with JAA authorities. The ARAC working group considered current international standards where they exist, and realized that restricting the upgrades to ED-55 standards would not satisfy the NTSB recommendation. The standards proposed are harmonized with the current JAR-Ops, which are based on the ED-55 standards; the additional U.S. requirements have no JAR counterpart with which to harmonize. No changes were made as a result of this comment.

Aerospace Industries Association (AIA) submits technical comments and editorial comments regarding typographical errors. For parameter 88, all cockpit flight control input forces (control wheel, control column, rudder pedal), AIA comments that the force sensor accuracy in the appendix should be changed from "+/-5%" to "+/-5% or +/-15% of actual, whichever is greater or as installed." AIA also comments that the accuracy values in the appendix for the Force Sensor Range for Wheel, Column, and Pedal ranges of parameter 88 should be changed to include the words "or as installed" after the numerical values. Also for parameter 88, AIA suggests the following language be added to the remarks column: "Force Sensor Range requirements are based on FAR 25.143(c)." Finally, AIA suggests that the Force Sensor requirements in the Accuracy column for parameter 88 should be moved from the Accuracy column to the Range column.

FAA Response: During ARAC working group meetings, NTSB representatives made it clear that the NTSB needs the full range control forces to be recorded as outlined in the NPRM with no exceptions. Force Sensor Range requirements in this rule are not based on the requirements in §25.143(c) because slightly stricter requirements are needed to yield the desired information for accident and incident investigation.

The FAA agrees that the Force Sensor requirements for parameter 88 should be moved from the Accuracy column to the Range column in the appendices; the change is reflected in this final rule.

AIA also commented that the following should be added to the Remarks column in the appendices for parameters 82, Cockpit trim control input position—pitch, 83, Cockpit trim control input position—roll, and 84, Cockpit trim control input position—yaw: "Where mechanical means for control inputs are not available, Cockpit Display Trim Positions should be recorded." Its rationale for the change is that modern transport aircraft do not always use mechanical trim controls.

FAA Response: The FAA concurs and the language in the Remarks column in the appendices for parameters 82, 83, and 84 has been revised.

Finally, AIA comments that the language in the Remarks column in the appendices for parameter 32, Angle of attack (if measured directly), is incomplete and should be changed to read as follows:

due to technical constraints such as sensor reliability, low level signal treatment, and aircraft installation, plus cost restraints and the low priority given to cockpit flight controls forces (as evidenced by their location in the order of the parameter list), it considers the recording of these parameters unnecessary. Embraer also comments that to be able to accommodate 88 parameters, it will be necessary to replace existing recorders that record 64 to 128 words per second (wps) with a new one capable of recording 256 wps, which is not presently available on the market. Embraer also submits cost figures for updating its software and hardware.

FAA Response: The NTSB recommendations on which this rulemaking action is based indicate that both control input and surface position are necessary for both conventional mechanical flight controls and fly-by wire controls. Past accident investigations support the need for this data. Further, although the NTSB has used derived information in support of some findings in accident investigation, the NTSB has noted that derived information may include too many variables to support the determination of probable cause of an accident.

The FAA acknowledges that some technical constraints regarding force sensors may currently exist. The recordation of the associated parameter, however, is not required until 5 years from the effective date of the final rule, and the FAA anticipates that within the next 5 years, these technical constraints will be overcome. Also, with regard to the ability to record 256 wps, the FAA maintains that there are recorders available today that include this technology, and expects them to be more readily available within 5 years, when newly manufactured airplanes must have recorders capable of recording all 88 parameters.

The FAA acknowledges that the DFDR enhancements proposed by this rule are expensive and that a recognized safety return may not immediately be recognized. However, the FAA maintains that the information collected will aid in accident and incident investigations and will help detect trends so that corrective measures can be taken before an accident occurs, and that collection of this data is in the public interest.

The FAA notes that the additional cost information submitted by Embraer is consistent with information submitted by ARAC working group members during development of the NPRM. Further discussion of other comments concerning economic issues can be found in this preamble under the section "Regulatory Evaluation." No changes were made to the proposal as a result of Embraer's comment.

Sheehan Consultants comments that the acceleration resolutions need to be upgraded in the final rule from 0.01g to 0.004g's to be consistent with the requirements in ED-55. It states that the change would have no impact on current recorders because they already meet the ED-55 requirements. The commenter states that accident investigators need very fine resolution to observe an airplane bouncing on the joints of a runway during taxi, takeoff, and landing, as well as other quick flight path changes, structural breakup, and explosions.

FAA Response: The FAA agrees that the resolution for all three acceleration parameters in parts 121, 125, and 135 should be changed to harmonize with the EUROCAE document ED-55. The final rule reflects the change in the resolution column of the appendices for parameters 5, 11, and 18 to read 0.004g's.

Aerospatiale and Alenia (ATR), manufacturers of ATR airplanes, comment that compliance with the primary flight control and master warning recording requirements would involve significant software modification and hardware modification of the flight data acquisition units (FDAU's), plus additional wiring. The two manufacturers state that the design changes would cost \$100,000 per aircraft for U.S. operators for parts and labor, in addition to down time associated with completing the modifications. ATR requests that some flexibility be introduced into the requirements that would take into account certain design features such as flight control characteristics or aircraft weight. In addition, ATR states that harmonization with the EUROCAE ED-55 requirements should be considered for the retrofit requirements.

angle, and hydraulic pressure are not necessary because the information can be derived from other data, or because the information is not relevant to the understanding of system operation. Airbus Industrie also suggests that the rule should retain the current language that would allow the proposed terms "record" and "recorded" to be replaced respectively with the terms "determine" and "able to be determined." In addition, Airbus Industrie comments that it has always installed advanced recording systems on its aircraft, but that aircraft already equipped to record 88 or more parameters may not be recording all of those proposed in the NPRM. Airbus Industrie suggests that the FAA require recordation of only those parameters included in EUROCAE ED-55, and states that anything else would constitute disharmony with European regulations. The commenter does not oppose the recordation of additional data, but would like to see more international involvement to determine what additional data should be included, and suggests that the effort be addressed within the ICAO and within the FAA/JAA Harmonization Work Program under the ARAC process before additional parameters beyond ED-55 are added.

Airbus Industrie also suggests that proposed §§ 121.344 and 125.226 be revised so that current FDR's that already record the necessary parameters, but not at the specific sampling or resolution readouts listed in Appendix K (corrected to read Appendix M), not be required to incur retrofit costs simply to meet those Appendix M values. Airbus Industrie believes that the introduction of this flexibility would result in significant cost savings to industry without jeopardizing the capability of investigating events.

FAA Response: The FAA acknowledges that there may be alternatives to obtain data other than direct recordation. However, the proposed sampling rates, resolution readouts, and parameter list in the NPRM represent contributions from industry representatives, the FAA, and the NTSB. During ARAC working group meetings, the NTSB argued that information gathered from interpretation was not as reliable as direct recordations, as discussed above. Some industry representatives did not agree. After further discussion, the working group decided that, to respond to the NTSB recommendations on which this rulemaking is based, the rule would be written with a requirement for direct recordation of the parameters listed. Although Airbus Industrie presents an alternative to obtaining information directly from a flight data recorder, the FAA has determined that justification provided by Airbus Industrie is not sufficient to overcome the NTSB's arguments that information gathered from interpretation is not as reliable as direct recordation. Accordingly, there was no change to the proposal as a result of this comment.

As previously stated, the FAA disagrees that international disharmony occurs as a result of this final rule. The ARAC working group made every effort to make the proposal identical, where applicable, to the requirements of ED-55. However, the FAA has determined that those requirements alone are insufficient for U.S. operators or U.S.-registered airplanes, and in fact would not satisfy the intent of the NTSB recommendations. Accordingly, the FAA proposed the additional requirements. The FAA disagrees with the suggestion that more international involvement is needed to develop U.S. regulations that govern U.S. operators and U.S.-registered airplanes. No changes were made as a result of this comment.

Fairchild Aircraft, Inc. (Fairchild), opposes the requirement for newly manufactured 10-19 seat airplanes to record 57 parameters effective 3 years after the effective date of the rule, and 88 parameters effective 5 years after the effective date of the rule. As proposed, the rule would require that these airplanes include a flight data acquisition unit (FDAU), plus the sensory devices and associated wiring for each (additional) parameter. Fairchild states that compliance with current § 135.152 and implementation of the proposed § 121.344a(a) is more than adequate for the size and complexity of any airplane in the 10-19 seat category. It is the commenter's understanding that the goal of this rulemaking is to provide information regarding accidents and incidents as they occur, and it notes that 10-19 seat aircraft have no history of accidents of undetermined cause.

Fairchild believes that the money needed to comply with the proposed regulations could be better spent improving overall operations. It states that an FDR will not increase the level of safety in the 19-seat airplane, and will probably diminish the level of safety, because funds will be diverted to comply with something of no value versus something of positive value. Fairchild also states that, if adopted, the proposal would have a significant negative impact on the competitiveness of current operators and airplanes made in the United States that are sold on the international market. Fairchild believes the

Fairchild requests that the following airplane types be added to the list of airplanes that need not comply with the requirements in § 121.344a, but continue to comply with the requirements in § 135.152: SA227-AC, SA227-TT, SA227-AT, and SA227-BC. As justification, Fairchild submits that these airplanes were manufactured prior to October 11, 1991, and are not commuter category airplanes.

FAA Response: As stated in the NPRM, when the NTSB made its recommendations in February 1995, the FAA has not yet issued its rule that requires most airplanes that have 10-19 seats that were formerly operated under part 135 to operate pursuant to the requirements of part 121 beginning in March 1997. Because the purpose of that rulemaking action was to establish "one level of safety," the NPRM associated with this final rule, and all rules developed from this point forward, reflect that agency policy. Recognizing the differences between larger airplanes operating under part 121 and those designed to carry 10-19 passengers, the FAA developed a special section in the NPRM to specifically address the flight data recorder requirements for these airplanes. The ARAC working group discussed and decided that the intent of the NTSB recommendations was to capture all airplanes regularly used in commercial service, including those that began operating under part 121 beginning in March 1997.

The FAA disagrees with the suggestion to delete § 121.344a(b) and (c) for newly manufactured airplanes. The suggestion is inconsistent with the NTSB recommendations, and no alternative to satisfy the recommendation was suggested. No change was made as a result of this comment.

The FAA agrees that the second reference to Appendix B in § 121.344a(a)(1)(iv) is an error; "Appendix B" should read "Appendix M." The rule has been revised accordingly.

The FAA finds that insufficient information was submitted to justify the addition of the following planes to the list of airplanes that need not comply with the requirements in § 121.344a, but continue to comply with the requirements in § 135.152: SA227-AC, SA227-TT, SA227-AT, and SA227-BC. The fact that airplanes were manufactured before October 11, 1991, is not considered sufficient to justify their exclusion. No change was made as a result of this comment.

The FAA agrees that the FH227 does not belong to Fairchild Aircraft, Inc., and the final rule has been revised to reflect the aircraft is a product of Fairchild Industries.

All typographical errors noted by the commenter have been corrected in this final rule.

Southwest Airlines (SWA) comments that the language proposed in § 121.344(b)(3) be changed to remove reference to installation no later than the next heavy maintenance check that occurs after two years after the effective date of the final rule. The commenter believes the final rule should only require compliance by the final date of the rule and should not include any milestones or restrictions. In addition, SWA comments that the sampling rates given in Appendix M have been increased from the rates initially proposed by ARAC working group members, and that the higher sampling rates may require additional modifications and expense.

FAA Response: The issue addressing the earliest possible compliance time was discussed in the preamble to the NPRM. In that document, the FAA stated that "heavy maintenance check" provision was added to prevent operators from waiting until the last minute to install upgrades, causing a logjam in scheduling and equipment availability. The proposed sampling rates reflect those needed by the NTSB to aid in accident and incident investigations. No changes were made as a result of this comment.

Airborne Express comments that lateral acceleration cannot be recorded at the specified recording intervals using the Loral F800 flight data recorder. Airborne Express states that 70% of its fleet is fitted with the Loral F800, and to replace these recorders would constitute an undue burden. The commenter suggests that language be changed to reflect that, except for the Boeing 737, lateral acceleration should not be required to be recorded unless sufficient capacity is available on the existing recorder to record that parameter and that the recording ranges, accuracies, and recording intervals be limited to those specified in current Appendix B to part 121. In addition, Airborne Express asks for clarification of

of information retrieved from FDR's, it believes "the one size fits all" approach to rulemaking is not an efficient or cost effective method. Piedmont believes the primary reason for the rule is two unresolved accidents that were due to loss of control. However, they do not agree that those accidents justify the proposal to obtain directly recorded data as opposed to obtaining information through alternative methods. Piedmont submits examples of two airplanes that will have to undergo some retrofit to comply with the rule as proposed. Piedmont believes that those airplanes are clear examples that existing recorded data is adequate for accident prevention and investigation, and that the proposed requirement will result in a costly retrofit for the purpose of a data-gathering exercise that is not justified by any benefit/cost comparison. Piedmont believes it would be cost beneficial to require recording up to 17 parameters but it disagrees that, other than for powered flight controls, both the control surface and the input need be recorded.

FAA Response: The FAA realizes that this rulemaking action may appear to be intended for certain airplanes that have been involved in accidents, the cause of which has not been determined. As stated in the NPRM, the FAA has determined that since the cause of these accidents is unknown, it is possible that similar incidents may occur on other airplane types. Therefore, the FAA finds that the need to record additional flight data is applicable to all airplanes covered by the final rule. The FAA recognizes that DFDR's do not in and of themselves prevent accidents; they are used as an investigative tool when accidents or incidents occur. However, the FAA does not agree that continuing the current level of data collection is acceptable for future accident investigation. The FAA recognized in the NPRM that additional flight data can be collected cost-effectively, particularly in light of the NTSB recommendations. No changes were made as a result of these comments.

Twin Otter International, Ltd. (TOIL) and its affiliate by ownership, Grand Canyon Airlines, Inc. (GCA) comments that its members use deHavilland DHC-6-300 airplanes in their operations. This airplane type went out of production before October 11, 1991. TOIL claims that the DHC-6-300 was not designed to accommodate flight data recorders, and that installation would require extensive redesign and would be prohibitively expensive. In addition, the manufacturer is not interested in participating in the cost of certifying and retrofitting the airplanes for flight data recorder installation and no other airworthiness authority worldwide requires a DFDR in the DHC-6-300. TOIL states that no DHC-6-300 has ever been equipped with a DFDR.

The commenter states that the reversal of the policy determination addressed in Notice 96-7 would create a regulatory inconsistency because 12 of its DHC-6-300 airplanes would be required to be retrofitted, while 26 others owned by the companies would not. It states that the same airplane type brought onto the register after October 11, 1991, is no less safe than one brought on before that date, and recommends that in lieu of reversing the policy determination, the FAA should revise proposed § 121.344a to read "manufactured after October 11, 1991," in lieu of "brought onto the U.S. register after . . ." that date. Further, the commenter points out, airplanes of foreign registration (not required to comply with U.S. DFDR requirements) may be allowed to be operated in the United States by a U.S. air carrier without being on the register, and would have an economic advantage over U.S.-registered airplanes.

FAA Response: Twin Otter International, Ltd. presented significant evidence why the DHC-6 airplane (Twin Otter) should be exempted from the flight data recorder upgrade requirements proposed in the NPRM, and the final rule includes an exemption for the DHC-6, whether the airplanes are operated under part 121 or part 135.

The FAA fully considered the popularity of this aircraft model in the sightseeing industry, and determined that the exemption is still appropriate. The FAA does not agree with TOIL's characterization of the effect of the policy change announced in Notice 96-7, nor that the policy announced in Flight Standards Information Bulletin 92-09 should be codified. The revised policy states that airplanes previously registered in the United States that were removed and brought back on the register after October 11, 1991 are not "grandfathered" and must install flight data recorders. This interpretation is consistent with both the language and the intent of the current rule. While the FAA acknowledges that the October 11, 1991 date creates two classes of airplanes that are otherwise the same, any other method of distinguishing

In a comment to the NPRM, Twin Otter International, Ltd. (TOIL) comments that two classes of airplanes are created by the "brought on the U.S. register" language because foreign registered airplanes may be operated in the United States. This issue was raised by the FAA in the SNPRM to this rule, and the agency proposed that the applicability of the regulation be changed to include airplanes brought onto the U.S. register or airplanes that are foreign registered and added to an operator's U.S. operations specification after October 11, 1991. As explained in the preamble to the SNPRM, the original language was adopted to minimize costs and to deter the importation of older, non-DFDR equipped airplanes. The fact that the language created a separate standard for non-U.S. registered airplanes was unintentional; the FAA always intended to cover all of the airplanes operating domestically. TOIL did not comment on the change proposed in the SNPRM. Based on the comment of TOIL, the final rule language includes an exemption for the Twin Otter. No other changes were made based on this comment.

The Regional Airlines Association (RAA) comments that it supports the enhancement of FDR recording parameters where the benefits can be shown to justify the costs, and suggests that the compliance period be extended to 6 years. RAA supports the proposed rule as it applies to newly manufactured aircraft. However, RAA states that many of the proposed requirements to retrofit new recording parameters into existing airplanes have not been shown to provide a direct safety improvement or to be cost effective, and that requiring installation will impose a severe economic burden on affected operators, resulting in increased costs of travel to the public, and thus should be eliminated.

FAA Response: The FAA recognizes that the DFDR enhancements proposed by this rule may be costly and may not provide immediately recognized benefits. However, cost alone cannot justify ignoring the potential safety gain represented by the improvements required by this rule. The FAA has determined that this final rule should be promulgated as in the public interest, and RAA has not submitted sufficient justification to show that it is not in the public interest. No changes were made as a result of this comment.

The Air Line Pilots Association (ALPA) agrees with the proposal except for the proposed compliance period, and suggests that the FAA contact FDR and FDAU manufacturers directly to validate the economic information supplied in the NPRM. The commenter believes that the four year compliance period outlined in the proposed rule for the retrofit of FDR's is too long, and that three years is more appropriate.

FAA Response: The FAA relied heavily on the industry members of the ARAC working group to supply accurate economic information, including costs of parts, labor, and aircraft down time. The information was provided in aggregate form based on major cost components, not in detail. Therefore, contacting the manufacturers of specific parts such as the FDR's and FDAU's would not yield useful additional economic information. During development of the proposal, the ARAC working group discussed extensively the most appropriate compliance period—one that would be practical both technologically and economically. Manufacturers and operators argued that four years is necessary to redesign any affected areas, and to incorporate any needed retrofits into a regular maintenance schedule in order to minimize the down time required for installation of DFDR enhancements. The FAA also notes that the required upgrades may be accomplished sooner than the prescribed four years; the final rule requires the installation of the DFDR no later than the next heavy maintenance check, or equivalent, after two years after the effective date of the final rule. No changes were made as a result of this comment.

General Aviation Manufacturers Association (GAMA) comments that the FAA has gone beyond the scope of the NTSB recommendations by including 10 to 19 passenger airplanes in the NPRM. GAMA also states that it considers the requirements proposed not to be cost beneficial, and thus a final rule should not be published. GAMA indicates that requiring enhanced DFDR's would not support the theory of eventual zero unexplained accidents per year simply by increasing the number of parameters being monitored. The commenter states that a regulatory analysis is not provided for newly manufactured airplanes and feels this is necessary by law and is essential. GAMA also disagrees with the FAA's conclusion that the cost of developing a 256 word per second recorder is insignificant. It cites the requirement to develop standards through committees, and the issue of possible import design and data correlation as additional cost burdens. GAMA comments that the FAA highlights the benefits of the NPRM and

GAMA also comments that several of the parameters' names or corresponding remarks are ambiguous and need to be further clarified. It further comments that the rule language should be changed to include in the rule text the appendix remarks concerning flight control breakaway capability; suggests that the dual coverage requirement for conventional axes be deleted; and suggests that the requirement for recordation apply to only aircraft axes that are augmented.

For newly manufactured airplanes, GAMA believes there are differences between parameters that some operators have chosen to record and proposed parameters 58–88. GAMA asks whether operators must cease recording parameters of choice or those required in the JAR-Ops and/or ED–55, and instead record the proposed extended parameters. GAMA believes clarification is needed regarding these issues.

FAA Response: As explained in the NPRM, when the NTSB made its recommendations in February 1995, the FAA had not yet issued its rule that requires most airplanes that have 10–19 seats that formerly operated under part 135 to comply with the requirements of part 121 beginning in March 1997. Because the purpose of that rulemaking action was to establish “one level of safety,” the NPRM associated with this final rule, and all rules developed from this point forward, reflect that agency policy. Recognizing the differences between larger airplanes operating under part 121 and those designed to carry 10–19 passengers, the FAA developed a special section in the NPRM to specifically address the flight data recorder requirements for these airplanes. The ARAC working group discussed and decided that the intent of the NTSB recommendations was to capture all airplanes regularly used in commercial service, including those 10–19 seat airplanes that began operating under part 121 in March 1997.

The FAA recognizes that increasing the number of recorded parameters may not realize an immediate safety return, but maintains that the information collected will aid in accident and incident investigations, and will help detect trends so corrective measures can be taken before an accident occurs. The FAA also maintains that as more information is recorded, the occurrence of unexplained accidents and incidents will decrease.

Regarding the commenters statements addressing the cost/benefit analysis, an analysis for newly manufactured airplanes, costs associated with developing a 256 word per second recorder, and other cost burdens: these and other comments concerning economic impact are discussed further in the Regulatory Evaluation section of this preamble.

The FAA disagrees that disharmony is created in the proposal, and notes that harmonization does not mean identity. The final rule is as similar as practicable with international standards, where they exist, and goes beyond international standards only to accommodate the NTSB recommendation, which is the original basis for this rulemaking action.

The FAA disagrees that the proposed rule language should be changed to exclude retrofit requirements for existing airplanes operated under part 135 for on-demand service. As proposed, the rule is not applicable to these airplanes. Only those part 135 airplanes that operate scheduled, commuter operations that have transferred to part 121 as of March 1997 will be subject to retrofit requirements in this rule. The FAA also disagrees that the proposed rule language should be changed to exclude newly manufactured airplanes that will be operated in on-demand service. For reasons stated in the preamble to the NPRM, the FAA finds that all airplanes affected should comply with the new regulations, regardless of the nature of their operation. The FAA disagrees with the commenter's suggestion that language be added to exclude airplanes certificated for nine or fewer passenger seats and all rotorcraft. Section 135.152 does not apply to airplanes with nine or fewer passenger seats, and the proposed language in § 135.152(f) applies only to airplanes that would be required to be equipped in accordance with §§ 135.152(a) or (b), as appropriate.

With respect to the commenter that some of the parameter name and corresponding remarks are ambiguous, the FAA notes that the names and remarks have evolved over time and are generally accepted by industry. The names and remarks were discussed during the ARAC working group meetings in which GAMA participated. No technical concerns over the names of the parameters were raised by the commenter

FAA finds that both of these requirements are needed to meet the NTSB recommendations.

Regarding the issue of recording required parameters rather than recording parameters of choice (or those required in the JAR-Ops and/or ED-55), the final rule states the parameters that must be recorded in each appropriate section. An operator may choose to record parameters beyond those required, but must record the required parameters. The FAA acknowledges that some operators may have to change the parameters currently being recorded, unless an operator chooses to replace its equipment for that with greater capacity.

The National Air Transportation Association (NATA) comments that proposed § 135.152 should be revised in the final rule to differentiate the applicability of the new requirements by "kind of operation" in which a 10 to 30 seat airplane is used. It also comments that the final rule language should be clarified concerning its applicability to 10 to 30 seat airplanes used in part 135 on-demand operations. The FAA is unable to understand clearly NATA's comment regarding proposed regulations for airplanes brought onto the U.S. register on or before October 11, 1991. The FAA concludes that NATA is suggesting that affected commuter airplanes operated under § 121.344a that are brought onto the U.S. register after October 11, 1991, should be required to meet only existing part 135 requirements. NATA appears to believe that there is no justification in requiring two sets of regulations for the same airplane type simply because of registration date, and suggests that the October 11, 1991, date be deleted and that the date of manufacture be used instead. NATA agrees with the exclusion of rotorcraft and airplanes certificated with nine or fewer passenger seats from the regulations, but feels that the term "multiengine," which is included in current § 135.152(a) and (b), should be included in proposed §§ 135.152(i) and (j).

FAA Response: The FAA appreciates the NATA comment but it does not agree that applicability is an issue for this final rule. The FAA recently promulgated new part 119, which determines the type of operation that is applicable to an on-demand or commuter operation. When using the definitions of part 119, it is clear that § 135.152 applies to on-demand operators of the 10-30 seat airplanes, and that § 121.344a applies to scheduled commuter operators. The FAA acknowledges that DFDR's do not in and of themselves prevent accidents; they are used as an investigative tool when accidents or incidents occur. However, it does not agree that continuing to obtain the current level of information required to be recorded by § 135.152 without obtaining any new information is acceptable for future accident investigation. Similarly, the FAA does not agree with NATA that the term "multiengine" should be included in the new §§ 135.152(i) and (j) for certain newly manufactured airplanes. In its deliberations, the FAA decided that a new, single-engine, turbine-powered airplane capable of carrying 10 to 30 passengers should meet the same standard as the multiengine airplane carrying the same number of passengers. Since NATA has not submitted any additional justification that would warrant different treatment of these airplanes, no changes were made as a result of this comment.

The Air Transport Association (ATA) generally supports the proposed rule, but expresses disagreement in the following areas. ATA comments that because the FAA proposes more parameters than are included in the JAR-Ops, harmonization is not achieved, and suggests that the FAA should restrict its list of parameters to those required by European standards, even if it means keeping the number of newly manufactured airplane DFDR parameters at 57. ATA also comments that increasing sampling rates in newer generation aircraft is not cost effective and recommends that several parameters be recorded at a sampling rate of once per second rather than twice per second as proposed. (The specific parameters will be addressed in the FAA reply.) In addition, ATA requests clarification regarding those aircraft that fall under the requirements of Appendix B and have the flight control breakaway capability that allows either pilot to operate the controls independently.

ATA comments that the Lockheed Aircraft Corporation Electra L-188 should be included on the list of airplanes that would not have to comply with the new proposal. The L-188 is out of production but remains in service. ATA also comments that the Loral 800 FDR does not have the capacity to record lateral acceleration at the rate of 4 words per second, as proposed. A two-engine airplane equipped with the Loral F800 is only capable of recording this parameter at a rate of 1 wps. ATA recommends

the manufacturer's accuracy should apply over the affected range.

ATA comments that some operators have established their DFDR Maintenance Programs using the current Appendix B parameter numbers for tracking and compliance purposes. ATA recommends that the final rule allow those operators that have a parameter-number-based FDR maintenance program to add the new parameters (numbers) to the original list, their maintenance manuals, and word cards.

ATA states that the FAA's time frame for compliance is more reasonable than that proposed in the NTSB recommendations, but still maintains there will be a tremendous burden on manufacturers, operators, and suppliers, as well as the FAA. Although FAA rejected ATA's earlier recommendation to establish a phased compliance schedule, ATA now suggests the FAA should survey operators annually after the effective date of the rule to determine the status of operator retrofit programs.

ATA states that with a few exceptions, its cost estimates generally agree with the data presented by the FAA in the proposed rule. It states, however, that some costs were not addressed in the NPRM, and consequently, ATA feels the FAA's cost estimates underestimate the total program costs.

FAA Response: The FAA disagrees that disharmony occurs as a result of this final rule. The ARAC working group made every effort to make the proposal identical, where applicable, to the requirements of ED-55. However, the FAA has determined that those requirements are insufficient to satisfy NTSB recommendations for U.S. operators, and has thus provided some additional requirements. The FAA recognizes that there may be other alternatives to obtain data, but no comprehensive alternative that would meet the NTSB recommendations has been presented, nor cost data submitted for comparison. The proposed sampling rates, resolution readouts, and parameter list in the NPRM were developed with input from industry representatives, the FAA, and the NTSB. The FAA has determined that justification provided by ATA is not sufficient to change the proposal.

The FAA agrees that the Lockheed Aircraft Corporation Electra L-188 should be included in the list of airplanes that need not comply with these amendments, and the applicable sections have been revised in the final rule.

The FAA does not agree that the Loral F800 is incapable of recording 4 samples per second (the FAA assumes ATA misquoted the NPRM when it said 4 words per second), as proposed. According to the manufacturer of the F800 recorder, lateral acceleration can be recorded at 4 samples per second if a nonrequired parameter is removed from the input to the recorder, and the existing spare channels are used.

Regarding specialized equipment configurations, the FAA requested for specific comment from TWA and other operators that may find themselves in unique circumstances. Although the ATA comment points out a unique problem with specialized FDAU's, the limitations are of recording system capacity caused by out-of-date software. The FAA is not inclined to revise the proposed rule in such a way to encourage the continued use of old, insufficient software. The FAA does acknowledge that extenuating circumstances may occur, and so may consider exemptions requesting relief from the recordation of specific parameters if an operator can show that all efforts to rearrange nonrequired parameters and software "fix" solutions have been exhausted, and that the only solution would be an expensive equipment upgrade.

The FAA acknowledges that some of the accuracies listed are not the same as those listed by the manufacturers, but maintains that to achieve the minimum level of safety prescribed by the rule, and to maintain the continuity of recorded data, the FAA must establish the standards, not the individual manufacturers.

The comment concerning operator maintenance programs is not a flight data recorder issue, and is beyond the scope of this rulemaking action. The current rule does not prohibit, and the NPRM did not propose to prohibit those operators with a parameter-number-based FDR maintenance program from adding new parameters (by number) to the original list, their maintenance manuals, or word cards.

newly manufactured and existing aircraft, and with the minimum parameter requirements for existing aircraft. It also disagrees with the FAA's decision not to require more expeditious flight control parameter upgrades for Boeing 737 airplanes, as required by the Board in its Recommendation A-95-25, and now suggests a December 1997 compliance date for retrofit of these airplanes.

In addition, for newly manufactured airplanes, the NTSB comments that most of the 88 parameters included in the FAA's proposal are currently being recorded, or are capable of being recorded with little cost, by existing FDR systems. Therefore, the NTSB believes that there does not appear to be a justifiable technical or economic reason for not requiring a full 88-parameter installation on newly manufactured aircraft by 3 years after the date of the final rule.

The NTSB also comments that the parameter "Overspeed Warning" should be added to the parameter list for newly manufactured airplanes, and that the final rule should explain in greater detail the significance of the Appendices Header, which reads "The recorded values must meet the designated range, resolution and accuracy requirements during dynamic and static conditions. All data recorded must correlate in time to within one second." The NPRM does not make it clear that this statement may have a significant impact on some existing airplanes with FDR parameters that do not reflect the actual condition of the aircraft during certain dynamic conditions. Certain data may not be recorded accurately due to filtering that takes place prior to recording.

The NTSB would like the FAA to change the proposed language to require non-FDAU equipped aircraft to be equipped with FDAU's and believes that the benefit would justify the additional \$50,000 per aircraft cost of this retrofit. Adding a FDAU enables the recording of all the FDR parameters recommended by the Board in Recommendation 95-26. It would also provide reserve capacity for future FDR parameter needs that may become necessary in the future as a result of accident investigations and/or technology advancements.

In addition to the 1997 compliance date for Boeing 737 retrofits and the 3-year compliance date for newly manufactured airplanes, the NTSB suggests that industry should be able to retrofit the affected existing fleet within 2 years from the issuance of the final rule, rather than the 4 years proposed in Notice 96-7.

FAA Response: The FAA has fully explored with ARAC the NTSB recommendations concerning the Boeing 737 and a 2-year versus 4-year compliance date. During the course of the ARAC working group deliberations, the aircraft manufacturers presented and justified arguments that they would need more than 3 years to incorporate the engineering designs necessary to accommodate the proposed parameters that are beyond those listed in ED-55. The FAA published the result of those deliberations in the NPRM, which provided the rationale for these proposals and the retrofit of the existing fleet. The aviation industry provided information that indicated a 2-year retrofit schedule would be prohibitively costly, and that it may be technologically impossible to complete a fleet retrofit in less than 4 years. In addition, a mandatory 2-year retrofit schedule would have had a major effect on the traveling public due to unscheduled groundings of airplanes that would be necessary to meet the requirement. During ARAC discussions, industry and the FAA found that a 2-year retrofit would be burdensome, and discussed whether a faster retrofit would result in expenditures that would undermine separate attempts to find the cause of incidents and accidents. Finally, the FAA determined that a 4-year compliance time would permit the operators to schedule DFDR retrofits during a major maintenance check, e.g., a "D" check, while the aircraft is at a maintenance facility that has the equipment and technical capability to perform the installation and the modifications to the airframe. The NTSB has presented no new persuasive arguments that would justify changing the proposal.

Since the Pittsburgh (Aliquippa) Boeing 737 accident, Boeing has concentrated its efforts on using the available actual data and derived data to better understand the possible causes of this accident. Boeing has recently introduced changes in the Boeing 737 rudder system that it believes will prevent future rudder-induced rollover accidents. The FAA acknowledges the merits of the Boeing program and notes

The Board's suggestion to add to the parameter list of "Overspeed Warning" was not raised during the NTSB's participation in the ARAC working group. The FAA is not including in the final rule in an effort to maintain consistency with the proposed rule and the substantial cost analyses done by industry for the parameters already proposed. The FAA will consider adding the parameter in future rulemaking.

The NTSB requests a more detailed explanation of the Appendices Header that, as proposed, reads: "The recorded values must meet the designated range, resolution and accuracy requirements during dynamic and static conditions. All data recorded must correlate in time to within one second." The FAA added the requirement for a *dynamic* test condition to ensure accurate dynamic recording of aircraft performance. This requirement was necessary to preclude the presumption that information that may be obtained from filtered or modified signals. Correlation must be within one second between recorded data and actual performance. The FAA agrees that further explanation of these tests is needed, and intends to address the test procedures in an upcoming Advisory Circular to clarify the recording of dynamic and static conditions, and other acceptable means of compliance with the rule.

The original NTSB recommendations did not fully recognize the considerable constraints of DFDR retrofit of older airplanes that are out of production and are not equipped with flight data acquisition units (FDAU's), and for transport category airplanes whose type certificates apply to airplanes still in production. The NTSB did not recommend that 88-parameter recorders be installed in those airplanes. The ARAC team discussed the differences between FDAU-equipped and non-FDAU-equipped airplanes and recognized that the NTSB recommendation could not be fully accommodated without a FDAU retrofit of older airplanes. However, the costs related to redesign and retrofit were found to be excessive when compared to the benefits gained in older, less complex airplanes. Therefore, the ARAC team recommended different retrofit requirements for three different categories of airplanes, depending on their age and equipment already installed. Those categories and requirements were discussed in Notice No. 96-7, and are summarized in a chart printed in this preamble. The FAA has fully debated this issue and disagrees with the NTSB comment concerning FDAU retrofit of older airplanes, including that an additional \$50,000 cost per older aircraft is justified. The FAA finds that the NTSB has submitted no new information that either was not considered by the FAA or that would justify developing a supplemental notice to incorporate this comment. No changes have been made as a result of the NTSB comment.

Several members on staff at the West Virginia University (WVU) comment that a virtual flight data recorder that they have been developing is capable of achieving the same result that an actual flight data recorder can, at much lower costs to industry. Congressman Nick J. Rahall II and Senator John D. Rockefeller IV, both of West Virginia, and the Air Transport Association (ATA) submitted comments in support of the WVU comment. The ATA states that the FAA and the NTSB should fund this technology.

FAA Response: The information presented in this comment is beyond the scope of this rulemaking action. It is ultimately the responsibility of the NTSB to determine whether this technology would be a useful accident investigation tool and provide the necessary funding for future research. The commenter's suggested methods of obtaining information from "virtual" flight data recorders in lieu of the proposed expanded flight data recorders, while interesting, would not satisfy the NTSB recommendations being addressed in this final rule, especially considering the NTSB's expressed need for directly recorded data. No change was made as a result of this comment.

An individual comments that the FAA does not provide a cost benefit analysis in the NPRM. In addition, the commenter believes the proposed rule is unnecessary and will not automatically improve aviation safety. He presents a number of hypothetical probable causes for accidents discussed in the preamble of the NPRM and suggests that improved inspection, maintenance, and training would better serve to prevent similar accidents. The commenter also states that it is necessary to record both pilots' inputs (force and displacement) as well as the control surface positions.

The FAA agrees that improved inspection, maintenance, and training are important elements of preventing accidents, but that there is no acceptable substitute for the additional data that will be gathered as a result of this rule.

Regarding the comment on the requirement for recording from the pilot and the copilot both force and displacement, the FAA maintains that the rule provides for the recording of both pilots' inputs. For clarification, the information in the "Remarks" column has been revised in the final rule.

An individual comments that he would like to see another item added to the NPRM in light of the recent crashes of ValuJet and TWA. Specifically, he suggests that the rule require an independent, lightweight, stand-by power supply to the CVR and FDR in the event of main bus power failure. He believes that power source should be available for 5 to 10 minutes. He believes that the NTSB agrees with his comment and asks for consideration in future rules if this comment cannot be included in this rulemaking.

FAA Response: The commenter did not present enough information to support the idea that a stand-by power supply would be useful during a catastrophic failure in which the recording sensors are disabled or destroyed. Since power sources for flight data recorder equipment were not part of the notice, the comment is beyond the scope of the rule, and no changes were made as a result of this comment.

Discussion of Comments to Proposals for Part 129

Airbus Industrie comments that it believes the most recent international standards, as established by ICAO, should be sufficient to meet the intent of the NTSB recommendations, and believes that to require additional standards for non-U.S. operators would impose heavy retrofit costs. The commenter believes that most parameters proposed can, with currently installed equipment, be either recorded directly or reliably determined from other data, and requests that more flexibility be allowed to derive certain parameters from other data as an alternative to direct recording.

FAA Response: The ARAC working group made every effort to make the proposal identical, where applicable, to the requirements of ED-55. However, the FAA has determined that those requirements alone are insufficient to satisfy the NTSB recommendations for U.S.-registered airplanes. Also, the FAA recognizes that there may be alternative methods available to obtain information, other than direct recording, but has determined that direct recordation is the most reliable method, and the best one to accomplish the needs of the NTSB. The NTSB has investigated a number of proposals wherein the proposed parameters were derived; however, the NTSB was not convinced that the methodology demonstrated was as accurate as direct recordation. No changes were made as a result of this comment.

Lufthansa German Airlines comments that a four-year compliance time is not sufficient to modify its fleet and maintains that, at a minimum, six years would be needed.

FAA Response: The commenter did not indicate the size of its fleet that would be subject to the retrofit requirements; however, the FAA would like to point out that the part 129 requirements apply only to U.S.-registered airplanes, not to the commenter's entire fleet. The FAA maintains that extending the compliance time would not significantly reduce the cost or down time involved per airplane. Since the commenter provided no further information regarding maintenance schedules or why the commenter could not meet a 4-year compliance date, no changes were made as a result of this comment.

Japan Airlines Company, Ltd. (JAL) comments that its Aircraft Integrated Monitoring System (AIMS) FDAU is almost fully occupied by parameters that JAL uses for monitoring on-board and ground-based operations. JAL maintains that requiring the recordation of additional parameters or increasing sampling rates would require modifications (including reviewing and rearranging all of the word slot assignments in its FDAU's) that would cost several million dollars and would require several months to accomplish. JAL requests that the FAA exempt from the final rule those airlines that are currently operating with AIMS, or to exempt those airlines from the proposed increased sampling rates for DFDR parameters.

The FAA again acknowledges that this rule will place some economic burdens on operators. Discussion of comments on economic issues can be found in the Regulatory Evaluation section of this preamble.

No other comments were received pursuant to these proposals. In the absence of sufficient, persuasive justification that is necessary to change the proposed regulations, they are adopted as proposed.

Discussion of Comments to the SNPRM

Two commenters stated that they support the proposals in the SNPRM.

TOIL submitted further comment to justify exemption of the DHC-6-300 from the DFDR retrofit requirements. The commenter's main concern is with "the proposed reversal of policy established by Flight Standards Information Bulletin 92-09" and again urges the FAA to adopt its previous policy interpretation regarding airplanes brought onto the register after October 11, 1991, and to codify that previous policy. TOIL did not offer comments on the proposals in the SNPRM.

FAA Response: The commenter seems to have misunderstood that the change in policy announced in the NPRM was a "proposed" reversal of policy. The change in policy was a determination already made; the NPRM was merely a conduit for announcing the change since the subject matter was relevant to the NPRM and the affected parties would be notified more efficiently using that document. As stated in the NPRM and the SNPRM, the previous policy interpretation was found to be inconsistent with the text of the rule. The FAA cannot, in good faith, allow operators to continue to operate without complying with the rule and has made no changes to the rule addressing the change of policy. Further explanation is provided in this preamble in the section, "Discussion of Policy Change" below.

One individual commented that the rule should address alternate methods of powering recording devices, stating that sometimes the busses powering the recorders are turned off for isolation purposes in the event of an emergency that involves fire or smoke.

FAA Response: The FAA acknowledges the merit of this comment; however, the issue it addresses is outside the scope of this rulemaking; it may be considered in a future rulemaking action. No changes were made as a result of this comment.

RAA comments that neither the NPRM nor the SNPRM have provided data to suggest that adoption of the proposals will result in a reduction of accidents, and therefore the final rule should not be applicable for aircraft where it is shown that disproportionate economic hardship would result. The commenter feels that aircraft with 10 to 19 passenger seats should be affected only if they are newly manufactured after October 11, 1991 (as opposed to being brought onto the U.S. register, as the rule currently states). RAA comments that if the FAA does insist on adopting the rule as proposed, the 2 year compliance time stated in the SNPRM should be revised to 4 years, stating that it doesn't make sense to propose a 2 year compliance time for some airplanes and 4 years for others.

FAA Response: The FAA acknowledges that immediate benefits from this rule may not be readily recognized in terms of reducing accidents, and that DFDR's themselves can prevent accidents. However, to respond to the NTSB recommendations to provide better investigative tools for accidents and incidents, the FAA undertook this rulemaking action. Aviation industry representatives supplied the FAA with figures for the economic evaluation that was presented in the NPRM. The cost figures that the RAA submits in this comment refer only to the DHC-6-300, an airplane with a unique combination of cost factors. The FAA has determined that the DHC-6 will not have to comply with the DFDR requirements. Other operators that can justify why their airplanes should also be exempt, discussing the criteria outlined in the preamble of the NPRM and the SNPRM, may petition to have their airplanes added to the exemption paragraph in part 135.

The FAA agrees that the 2-year compliance time for airplanes of operators that "thought their aircraft were grandfathered to meet the current requirements of part 135, not for installation of an upgrade" should be revised to read 4 years, and those affected airplanes will have 4 years to come into compliance.

for exclusion. The NTSB agrees that the increase in the minimum FDR recording duration for part 135 aircraft from 8 to 25 hours is an appropriate and timely change.

FAA Response: The language proposed in the SNPRM, that the flight data recorder requirements of § 135.152 apply to aircraft registered outside the United States but placed on the U.S. operations specifications of an operator, is included in the final rule. In its comment, the NTSB indicates that specific language should also be added to part 121 requirements to ensure that all aircraft operated in part 121 service, including those under foreign registration, are operated in accordance with the flight data recorder requirements of that part. The NTSB indicates that § 121.153 would permit the use of foreign-registered aircraft that record only 5 parameters of flight data. The FAA disagrees with the NTSB's reading of § 121.153. Paragraph (c)(2) of that section requires that foreign-registered aircraft operated under part 121 must meet all of the requirements "of this chapter (14 CFR Chapter 1)," which includes all of the part 121 requirements. Thus, any foreign-registered airplane operated under part 121 must meet the FDR requirements as though the aircraft were registered in the United States.

However, after further consideration, the FAA has decided that § 121.344a should contain the same language as § 135.152 concerning aircraft placed on the operations specifications of an operator. The "brought on the U.S. register" language of § 135.152 was repeated in new § 121.344a(a), and the correction proposed for § 135.152(a) in the SNPRM also applies to § 121.344a(a). The language is included in the final rule for clarity and parallelism between the two sections. The FAA does not want to cause confusion in the applicability of § 121.344a for airplanes that are subject to it beginning in March 1997.

The FAA agrees that the simple fact that airplanes are out of production is not sufficient justification for their exclusion from the DFDR requirements. The number of out of production airplanes still operating is significant, and many airplanes have too much economic life remaining to allow them to operate with no or limited flight data recorders. The FAA disagrees that any exception to this rule be handled as exemptions on a case-by-case basis. The FAA does not grant blanket permanent exemptions, and use of that process would necessitate the reapplication of affected parties every two years. The FAA does not anticipate that circumstances would change so as to justify later the retrofit of the airplanes listed in this final rule as exempt. Further, because these exceptions are listed for aircraft types, it is more efficient to list them as part of the rule rather than having individual operators apply on behalf of themselves and all affected operators of a certain airplane type design.

Discussion of Policy Change

In the preamble to Notice No. 96-7, the FAA announced a change in policy regarding certain airplanes that were brought on the U.S. register after October 11, 1991 (61 FR 37154, July 16, 1996). The language of current § 135.152 is clear that any aircraft subject to that section that was brought onto the U.S. register after that date would have to meet the flight data recorder requirements of that section. As explained in that Notice, there has been at least one previous policy determination that certain airplanes—those that were on the register before October 11, 1991, were taken off, and were added to the register again after October 11, 1991—do not have to meet the DFDR requirements because of their previous registration. As noted, this policy is inconsistent with the clear language of the rule, and with the recently adopted rules making part 135 scheduled commuter airplanes subject to part 121 beginning in March 1997.

Comments to the NPRM and SNPRM, and telephone inquiries by operators, indicate to the FAA that some commenters thought that this was a *proposed* policy change. Commenters also took the opportunity to suggest alternative policies to cover these airplanes, including a change in § 135.152 to make it applicable only to airplanes manufactured after October 11, 1991. (See response at discussion of TOIL's comments, above.) Further, the NPRM did not contain any proposed compliance time for aircraft affected by the policy change, nor did it specifically indicate that the policy change affects all aircraft—airplanes and rotorcraft—subject to § 135.152.

years from the effective date of this rule in which to comply with § 135.152. Affected operators should note, however, that there is *no change to the rule language* of § 135.152 to indicate that this compliance period exists. The FAA found that a change in the rule language could be interpreted to apply to all operators, rather than those affected by the policy change; the compliance date proposed in the Supplemental Notice is not adopted in this final rule.

Changes Adopted in the Final Rule

As a result of comments to the NPRM, the following changes were made:

(1) The Lockheed Aircraft Corporation Electra L-188 airplane was added to the list of airplanes that need not comply with proposed §§ 121.344 and 125.226, but must continue to comply with §§ 121.343 or 125.225, whichever is appropriate;

(2) The reference to Fairchild Aircraft, Inc. FH 227 was corrected to reflect the manufacturer of the FH 227 is Fairchild Industries;

(3) In all appendices, the following comment was added to the Remarks column for Parameter #88: For airplanes that have a flight control break away capability that allows either pilot to operate the controls independently, record both control force inputs. The control force inputs may be samples alternately once per 2 seconds to produce the sampling interval of 1;

(4) Technical changes to the appendices, including sampling rates; and

(5) Typographical errors were corrected and minor editorial changes were incorporated.

As a result of the SNPRM and comments to the SNPRM, the following changes were made:

(1) Proposed § 121.344a(a) and comment § 135.152(a) were revised to include turbine-engine-powered airplanes having a passenger seating configuration, excluding any required crewmember seat, of 10 to 19 seats, that were brought onto the U.S. register after, *or* that were registered outside the United States and added to the operator's U.S. operation specifications after, October 11, 1991;

(2) Section 135.152(k) was added to state that the deHavilland DHC-6 (The Twin Otter) airplane need not comply with DFDR rules. Parts 121 and 125 already included exception paragraphs; the DHC-6 was the only part 135 airplane for which justification was shown to grant noncompliance;

(3) References in part 135 to 8 hours of recorded aircraft operation were revised to read 25 hours, which reflects the current industry standard; and

(4) The rule language proposed in the SNPRM to allow a 2 year compliance time for airplanes currently not in compliance was not adopted in the final rule. These aircraft were operating without DFDR's based on a previous policy interpretation, the reversal of which was announced in the preamble of the NPRM. The policy interpretation was changed to be consistent with the current rule language, and no change in the rule language is necessary.

(5) Each of the exemption paragraphs has been revised to indicate that the exemption applies only to aircraft manufactured before the effective date of this final rule.

FLIGHT DATA RECORDER UPGRADE REQUIREMENTS

| Category 1 No FDAU*, mfd on or before 10/11/91 | Category 2 FDAU, mfd on or before 10/11/91 | Category 3 FDAU, mfd after 10/11/91 | Category 4 FDAU, mfd 3 (or 5) years after final rule |
|--|--|---|--|
| CURRENT PARAMETERS | | | |
| 11 parameters | 17 parameters | Up to 29 parameters | 29 parameters |

| | | | |
|--|--|---|--|
| 1929 airplanes over 30 seats; 727, 737, DC-8, DC-9, F-28 | 1360 airplanes over 30 seats 704 turboprops A-320, 737, 747, 757, 767, DC-10, F-28, MD-80, ATR-42, EMB-120, SAAB 340, DHC-8, L- 1011 | 1036 airplanes over 30 seats 673 airplanes 10-19 seats 277 airplanes 20-30 seats 737, 747, 757, 767, 777, F- 100, MD-11, MD-80, MD-88, MD-90, ATR-72 | All newly manufactured air- planes Existing derivatives and any new type certificates |
|--|--|---|--|

* FDAU=Flight Data Acquisition Unit

International Compatibility

The FAA has reviewed corresponding International Civil Aviation Organization regulations and Joint Aviation Authority regulations, where they exist. Any differences between those documents and these regulations are of a minor, technical nature, and are deemed insignificant. As noted in the discussion of comments, the review included the technical material for parameters numbered 1 through 57. Beyond parameter 57, no international standards exist. The differences noted above will not adversely affect harmonization.

Paperwork Reduction Act

This final rule contains information collections which are subject to review by OMB under the Paperwork Reduction Act of 1995 (Pub. L. 104-13). The title, description, and respondent description of the annual burden are shown below.

Title: Revisions to Digital Flight Data Recorders Rules.

Description: This regulation revises and updates the Federal Aviation Regulations to require that certain airplanes be equipped to accommodate additional digital flight data recorder (DFDR) parameters. These revisions follow a series of safety recommendations issued by the National Transportation Safety Board (NTSB), and the Federal Aviation Administration's (FAA) decision that the DFDR rules should be revised to upgrade recorder capabilities in most transport airplanes. These revisions will require additional information to be collected to enable more thorough accident or incident investigation and to enable industry to predict certain trends and make necessary modifications before an accident or incident occurs.

Description of Respondents: Businesses or other for profit organizations.

There are no annual reporting or recordkeeping burdens associated with this rule. The information is collected automatically, electronically. It is retained for only 25 hours, and is overwritten on a continuing basis. In the event of an accident or incident, the information is downloaded by the NTSB as a part of its statutory mission. The airplane operators are not required to keep the information, nor to report it.

Cost estimates shown here are aggregates for the entire 4-year compliance time frame. In determining capital and start-up costs to the airline industry, the FAA has assumed that in determining the figures, commercial airline operators took into account the annualized expected useful life of the equipment to be installed in their aircraft. Total capital investment costs, as detailed in the Regulatory Evaluation are estimated at \$155.4 million (\$131.6 million discounted), and engineering costs are estimated at \$3.2 million (\$2.7 million discounted). Other costs, which include recurrent and nonrecurrent maintenance costs and costs associated with retrieving information from DFDR units following an accident or incident, are estimated at \$16.4 million (\$11.4 million discounted).

The agency solicits public comment on the information collection requirements in order to: (1) Evaluate whether the proposed collection of information is necessary for the proper performance of the functions of the agency, including whether the information will have practical utility; (2) evaluate the accuracy of the agency's estimate of the burden of the proposed collection of information, including the validity

Persons are not required to respond to a collection of information unless it displays a currently valid OMB control number. The burden associated with this final rule has been submitted to OMB for review. The FAA will publish a notice in the *Federal Register* notifying the public of the approval numbers and expiration date.

Regulatory Evaluation Summary

Changes to Federal regulations must undergo several economic analyses. First, Executive Order 12866 directs that each Federal agency shall propose or adopt a regulation only upon a reasoned determination that the benefits of the intended regulation justify its costs. Second, the Regulatory Flexibility Act of 1980 requires agencies to analyze the economic effect of regulatory changes on small entities. Third, the Office of Management and Budget directs agencies to assess the effect of regulatory changes on international trade.

With regard to Executive Order 12866, the FAA determined that this rulemaking is significant because of the substantial public interest in obtaining flight data and the NTSB's ability to conduct full investigations. Accordingly, the FAA evaluated two alternative approaches. In consideration of these alternatives, the FAA has concluded that (1) shortening the compliance time frame to two years as analyzed in the NPRM, would increase the cost of this rulemaking by as much as \$170.6 million, discounted; and (2) adopting a simulator methodology to obtain more DFDR parametric detail, although less costly, would not measure all parameters specified in this final rule, nor satisfactorily meet the needs of the NTSB. Hence, the FAA has rejected both of these alternative approaches.

With regard to the Regulatory Flexibility Act of 1980, the FAA has determined that a substantial number of small entities will not be significantly affected economically by this final rule. With regard to the OMB directive, the FAA has concluded that this final rule could have a potential, but insignificant, indirect affect on international trade. A full regulatory evaluation of the final rule providing a detailed discussion of the costs and benefits summarized in this section is available in the docket for this rulemaking action.

Costs

To obtain representative and comprehensive information from which to develop the industry costs of this final rule, the FAA relied on the responses of the Air Transport Association (ATA) and the Regional Airline Association (RAA) members to an air carrier cost survey developed by the ARAC working group. (The FAA augmented this information with adjusted cost analyses from the recently effectively commuter rule). The principle aggregate costs detailed in the cost survey were (1) equipment and inventory/spares; (2) engineering, installation, and other costs, inclusive of recurrent maintenance costs; and (3) aircraft out-of-service costs, which reflect net operating revenue losses resulting from unscheduled aircraft downtime.

The FAA estimates that total costs for air carriers operating turbojets under part 121 would equal \$308.9 million (\$259.1 million, discounted) within the 4-year compliance time frame of this rulemaking. The equivalent total turboprop fleet costs for air carriers operating under part 121 are estimated to be \$30.4 million (\$25.8 million, discounted) under the same 4-year compliance time frame. Estimates of the total 4-year compliance time frame costs for part 135, 10–19 seat aircraft required to operate under part 121 as of March 1997 are \$26.4 million (\$22.3 million, discounted) and for part 135, 20–30 seat aircraft, are \$10.9 million (\$9.2 million, discounted). Total part 135 costs are \$37.3 million (\$31.5 million, discounted). Thus, the estimated total 4-year compliance time frame discounted costs for the retrofits required under this final rule are \$316.3 million.

The costs associated with upgrading the industry's turbojet fleet with the new DFDR requirements are in excess of 80 percent of the total air carrier industry costs (turbojets, turboprops and part 135 airplanes required to begin operating under part 121 in 1997). Just over 20 percent of the total turbojet fleet costs (\$70.1 million; \$59.4 million, discounted) are out-of-service costs or lost net operating revenues that result from this rulemaking. No similar estimates of the out-of-service costs were provided to the

potentially averting an accident as a result of the DFDR enhancements.

In the first instance, this final rule supports the recent voluntary efforts of those air carriers that have introduced data acquisition enhancements into their newer model airplanes. This subset of new airplanes with upgraded DFDR's has provided certain air carriers with "quick access" capability and allowed for the development of integrated maintenance and training programs predicated on the additional information being collected. It has also allowed for more rapid and comprehensive detail to be obtained by the FAA and NTSB in certain recent airplane accidents. The inherent benefits resulting from this rulemaking will evolve as all commercial air carriers adopt the required DFDR enhancements in their airplanes.

Although DFDR's do not in and of themselves prevent accidents, through their use as an investigative tool when accidents or incidents do occur, trends that may adversely affect flight operations in certain airplanes can be determined. Accident investigators in obtaining a greater understanding of the accident dynamics from the DFDR information, can, in turn, be used to more easily determine the probable causes of accidents and incidents. With this knowledge, a "fix" can be developed to reduce the chance of a similar occurrence in the future.

In the second instance noted above, although the FAA is not able to quantify precisely the likely benefits that will ultimately result from this rulemaking, the FAA anticipates that the DFDR enhancements required by this final rule will lead to a reduction in accidents and a saving of lives. As a result of analyzing incidents involving aircraft with DFDR enhancements in place, the FAA finds that there is a reasonable prospect that as many as 1.43 accidents could be prevented over the next 20 years. This could save up to 143 lives. The FAA anticipates that, particularly in light of the NTSB recommendations, information concerning enhanced parameters can be collected cost-effectively; it is also expected that the FAA will be able to use incident information to reduce accidents of the nature that are currently of undetermined cause.

Benefit Cost Comparison

The FAA cautions that the cost analysis detailed in the preceding sections is not necessarily exhaustive. The purpose of this rulemaking is to require the installation of DFDR's that record more flight information. This in turn, will allow industry to recognize certain trends in order to make any necessary modifications to avoid future accidents or incidents. Thus, the FAA presumes that, as a result of this rulemaking, the quantity and quality of information will increase. To the extent that NTSB is able to make findings of probable cause in the event of accidents or incidents, the FAA will be able to determine what, if any, appropriate additional action is needed to prevent a recurrence of those kinds of accidents or incidents.

Future FAA actions could take the form of Advisory Circulars, Airworthiness Directives, or possibly, additional rulemaking. The costs of these follow-on FAA actions could vary from negligible costs to considerable costs of some unknown amount. While the costs of such future follow-on actions by the FAA might be considered part of the costs of this rulemaking, the FAA cannot estimate the costs of these unknown future actions. The FAA acknowledges that, to the extent that the costs of any follow-on actions are more than negligible, the current cost estimates would tend to underestimate the total cost of this rulemaking.

Public Comments on Economic Issues in the NPRM

The FAA received comments from twenty-six parties in response to the published DFDR NPRM. Most of the comments concerned engineering and other technical detail germane to the reconfiguration requirements; fewer comments presented any detailed economic considerations of the proposed rule. This was expected since the regulatory evaluation and economic analysis were derived from the airline-specific cost information as provided through the ATA and RAA, both of which participated in the ARAC process. The comments containing more specific economic content are summarized below.

or including for retrofit certain aircraft that currently have demonstrably effective recorder systems. In addition to the above noted ATR 42, ATR 72, and SAAB 340, the RAA, in an attachment submitted by Atlantic Southeast Airlines, Inc. (ASA), objects to the retrofit of BAe 146 and EMB-120 aircraft. ASA also cites a previous estimate submitted by Aerospatiale to retrofit the ATR 72 as costing \$30,000 and 20 man-hours per aircraft, and a previous estimate submitted by AVRO to retrofit the BAe 146 as costing \$110,000, 1200 man-hours, and 2.5 weeks downtime per aircraft.

In another statement submitted with the RAA comment, Comair believes the recorder capabilities currently employed on its in-service fleet far exceed those of the rulemaking's "target aircraft", e.g., older 737's and DC-9's. Comair also provided retrofit cost data for its fleet of 40 Embraer EMB 120 aircraft (\$51,450 and 6 days downtime per aircraft) and its fleet of 70 Canadair CL600-2B19 regional jets (\$136,600 and 6 days downtime per aircraft). Although not part of the RAA comment and attachments, Embraer also provided detailed cost information for the retrofitting of the EMB-120 aircraft under each of the categories specified in the rule. Embraer's retrofit cost estimates are more in line with those presented in the NPRM and considerably less than those cited above.

A statement from USAir Express notes that the cost data submitted by the RAA were primarily for aircraft operated by RAA members under part 121, not part 135 as estimated in the regulatory evaluation; only the EMB-120 is operated exclusively under part 135. As a consequence, RAA/USAir Express suggest that the FAA cost estimates for retrofitting aircraft operating under part 121 are from 5 percent to 10 percent low.

Finally, Twin Otter International (TOIL) contends that the DHC-6-300, which is no longer in production, was not designed for FDR's and no engineering data exists to support an FDR installation. TOIL estimates the costs to redesign the DHC-6-300 aircraft systems and recertify would be in excess of \$130,000, and deHavilland, the Twin Otter manufacturer, has no interest in participating in the cost of certifying/retrofitting the DHC-6-300. TOIL concludes that application of the rule would inhibit the ability of U.S. operators to purchase additional aircraft, particularly since the majority of available Twin Otters are registered outside the U.S.

FAA Response: The FAA appreciates the additional cost detail regarding aircraft operating under part 135 as provided in these comments, as well as the clarification of the cost detail as provided by the RAA. The FAA relied heavily on ARAC working group members to supply accurate and timely cost detail and economic information. This reliance also assumed that the cost detail supplied clearly delineated the retrofit costs associated with aircraft operating under part 135 from those operating under part 121.

With regard to the so-called "requirements flexibility" or possible exemption of certain aircraft, this is not a matter for consideration in the regulatory evaluation. It should be noted that the ARAC working group, with significant industry input, concluded that the differences between the NTSB recommendations and ED-55 would be insignificant for U.S. operators. Finally, with regard to the DHC-6-300 airplane (the Twin Otter) the FAA received sufficient information to support the exemption of these aircraft operated under part 135. Section 135.152(k) was added to provide that exemption.

Several comments were received regarding the 88 parameter list for airplanes in category V (those that will be manufactured five years after the effective date of this rule), most of which noted the absence of a detailed cost/benefit analysis specific to this requirement for future newly manufactured aircraft. Airbus Industrie notes an inexact match between the 88 or more parameters currently being recorded by some European manufacturers of FDRs and those on the NTSB list. This is also true of the currently operational A300-600/310 and A319/320/321 aircraft which can record up to 270 parameters and the A330/A340 models which can record up to 400 parameters.

The Air Line Pilots Association (ALPA) notes that the cost data supplied by ATA and RAA was inclusive only up to 57 parameters (category IV), but contends that there is no justifiable technical or economic reason not to include 88 parameters 3 years (not 5 years) after the promulgation of the final rule as is the case with the 57 parameter group. Fairchild Aircraft disagrees with the position

FAA Response: The FAA notes that no cost detail for the 88 parameter list was included in the information provided by ATA or RAA for analysis in the NPRM, and the detail that was provided for the 57 parameter list was incomplete and essentially unusable. In both cases, this was due to the lack of adequate vendor cost detail for products which may not even be on the market as yet, and the generally speculative nature that would be required of air carriers in developing macro cost breakouts for newly manufactured airplanes in the future. These impediments were recognized by the ARAC working group, and, as a consequence, no request for this information was tendered.

With regard to the remaining issues noted above concerning the parameter requirements of newly manufactured airplanes, the potential cost burden, and the apparent excessive cost/benefit ratio, Federal regulations in general, require only that the complete rule be subjected to a cost/benefit analysis, not its component parts. Furthermore, although the cost information provided by ATA and RAA allowed detailed analysis of the first three aircraft categories, an analysis of the benefits cannot be estimated in similar manner; benefits therefore, were determined for the overall rule. Finally, as noted in the preamble, cost alone cannot justify ignoring the recognized potential safety gains inherent in this rule, the inclusion of certain airplanes now operating under part 135 to comply with the requirements of part 121 is a result of the commuter or "one level of safety" rule.

With regard to parts vendors and the disaggregation of materials costs, comments were received from two suppliers (Flight Systems Engineering, Inc. and Patriot Sensors and Controls Corporation) and one trade association (Airlines Pilot Association (ALPA)). The vendors' comments addressed the costs of specific equipment components and the lead time required to meet orders. A portion of ALPA's comments focused on the need for a more extensive review of cost data and recommended contacting individual manufacturers of FDRs and FDAUs.

FAA Response: The FAA appreciates the logistics information regarding vendor lead times which are well within the 4-year compliance time of this final rule. The FAA however, notes that the cost data developed for this rulemaking was provided by ATA and RAA at the aggregate level; it does not lend itself to the micro detail of specific retrofit components. No changes to the regulatory evaluation or the rule were made in response to these comments.

Finally, a comment was submitted by the Department of Civil and Environmental Engineering of the University of West Virginia (WVU) proposing an alternative approach to the retrofitting requirements of this rule based on Artificial Intelligence, or more specifically, Neural Network theory. Relying on an alternate set of assumptions, the WVU team estimates the cost of the DFDR final rule at \$1.046 billion, or more than three times the FAA estimate, and offers their software-based system, the Virtual Flight Data Recorder (VFDR), as a low-cost alternative. Utilizing the data taken from an existing conventional 11-parameter FDR, the VFDR, according to the WVU team, would accurately "reconstruct" most of the additional parameters detailed in the final rule via a Neural Network mapping process at a cost of about \$800-\$1,000 per aircraft, or about 1 percent of their cost estimate for this final rule. The WVU comment concludes that the opportunity cost of the hard retrofit is lost savings which could be invested in a variety of safety enhancements.

FAA Response: The FAA appreciates the efforts of the WVU team in presenting an innovative, low-cost "simulator" alternative to the hardware retrofits that will be required by this rule. However, the rulemaking is concerned with expanding the number of parameters to be recorded as requested by the NTSB, not with revising the means by which additional data can be collected. The NTSB has made it clear that its requirements must be met by direct parametric measurement via recorder, and has not supported industry comments with respect to parameter redundancy or inference from parameters already recorded. The FAA supports the continued efforts on the part of the WVU team to disseminate VFDR information to the NTSB, FAA Research Office and airline industry. The FAA, through this rulemaking, takes no position at this time on the VFDR or the commenter's measurement of the opportunity costs of this final rule.

A "significant economic impact" or cost threshold, is defined as an annualized net compliance cost level that exceeds (1) \$122,400 (1995 dollars) in the case of scheduled operators of aircraft for hire whose entire fleet has a seating capacity in excess of 60 seats; (2) \$69,800 (1995 dollars) in the case of scheduled operators of aircraft for hire for which the entire fleet has a seating capacity less than or equal to 60 seats; and (3) \$4,900 (1995 dollars) in the case of unscheduled operators of aircraft for hire.

The FAA has determined the annualized costs (20 years) for scheduled operators of large aircraft to be \$5,611 per aircraft. Multiplying this estimate by 9, (the upper bound of the small entity criteria) yields a result of \$50,501. This estimate is significantly below the minimum compliance cost criteria of \$122,400 for scheduled operators of large aircraft.

The FAA has also determined the annualized costs (20 years) for scheduled operators of small aircraft to be \$3,067 per aircraft. The upper bound costs for consideration within the small entity (9 aircraft) criteria are \$27,603, which is well below the minimum compliance cost of \$69,800. Thus, the FAA has determined that a substantial number of small entities will not be significantly affected by this final rule.

International Trade Impact Assessment

The FAA anticipates that revisions to digital flight data recorder rules could have some indirect effect on international trade. The FAA finds that while the final rule will not effect non-U.S. operators of foreign aircraft operating outside the United States, it could affect the suppliers of materials required for retrofitting the affected aircraft in the domestic fleet. Domestic sources of the required retrofit components may not be able to meet all of the increased demand of the domestic air carriers for DFDR's as these air carriers increase their orders to meet the compliance time frame for these regulations. Foreign producers may benefit by supplying the unfilled orders.

Conclusion

For the reasons discussed in the preamble, and based on the findings in the Regulatory Flexibility Determination and the International Trade Impact Analysis, the FAA has determined that this final rule is a significant regulatory action under Executive Order 12866. In addition, the FAA certifies that this rule will not have a significant economic impact, positive or negative, on a substantial number of small entities under the criteria of the Regulatory Flexibility Act. This rule is considered significant under Department of Transportation Order 2100.5, Policies and Procedures for Simplification, Analysis, and Review of Regulations. A regulatory evaluation of the rule, including a Regulatory Flexibility Determination and International Trade Impact Analysis, has been placed in the docket. A copy may be obtained by contacting the person identified under the heading "FOR FURTHER INFORMATION CONTACT."

The Amendment

In consideration of the foregoing, the Federal Aviation Administration amends 14 CFR parts 121, 125, 129 and 135 of the Federal Aviation Regulations effective August 18, 1997.

The authority citation for part 125 continues to read as follows:

Authority: 49 U.S.C. 106(g), 40113, 44701-44702, 44705, 44710-44711, 44713, 44716-44717, 44722.

Inoperable instruments and equipment.

[(a) No person may take off an airplane with inoperable instruments or equipment installed unless the following conditions are met:

[(1) An approved Minimum Equipment List exists for that airplane.

[(2) The Flight Standards District Office having certification responsibility has issued the certificate holder operations specifications authorizing operations in accordance with an approved Minimum Equipment List. The flight crew shall have direct access at all times prior to flight to all of the information contained in the approved Minimum Equipment List through printed or other means approved by the Administrator in the certificate holders operations specifications. An approved Minimum Equipment List, as authorized by the operations specifications, constitutes an approved change to the type design without requiring recertification.

[(3) The approved Minimum Equipment List must:

[(i) Be prepared in accordance with the limitations specified in paragraph (b) of this section.

[(ii) Provide for the operation of the airplane with certain instruments and equipment in an inoperable condition.

[(4) Records identifying the inoperable instruments and equipment and the information required by paragraph (a)(3)(ii) of this section must be available to the pilot.

[(5) The airplane is operated under all applicable conditions and limitations contained in the Minimum Equipment List and the operations specifications authorizing use of the Minimum Equipment List.

[(b) The following instruments and equipment may not be included in the Minimum Equipment List:

[(1) Instruments and equipment that are either specifically or otherwise required by the airworthiness requirements under which the airplane is type certificated and which are essential for safer operations under all operating conditions.

[(2) Instruments and equipment required by an airworthiness directive to be in operable condition unless the airworthiness directive provides otherwise.

[(3) Instruments and equipment required for specific operations by this part.

[(c) Notwithstanding paragraphs (b)(1) and (b)(3) of this section, an airplane with inoperable instruments or equipment may be operated under a special flight permit under §§ 21.197 and 21.199 of this chapter.]

[(Amdt. 125-15, Eff. 6/20/91)]

§ 125.202

[Removed]

§ 125.203

Radio and navigational equipment.

(a) No person may operate an airplane unless it has two-way radio communications equipment able, at least in flight, to transmit to, and receive from, ground facilities 25 miles away.

(b) No person may operate an airplane over-the-top unless it has radio navigational equipment able to receive radio signals from the ground facilities to be used.

(c) [Except as provided in paragraph (e) of this section,] no person may operate an airplane carrying passengers under IFR or in extended overwater operations unless it has at least the following radio communication and navigational equipment appropriate to the facilities to be used which are capable of transmitting to, and receiving from, at any place on the route to be flown, at least one ground facility:

(1) Two transmitters, (2) two microphones, (3) two headsets or one headset and one speaker, (4) a marker beacon receiver, (5) two independent receivers for navigation, and (6) two independent receivers for communications.

(d) For the purposes of paragraphs (c)(5) and (c)(6) of this section, a receiver is independent if the function of any part of it does not depend on the functioning of any part of another receiver. However, a receiver that can receive both communications and navigational signals may be used in

approved in the certificate holder's operations specifications. The following are among the operational factors the Administrator may consider in granting an authorization: (1) the ability of the flightcrew to reliably fix the position of the airplane within the degree of accuracy required by ATC, (2) the length of the route being flown, and (3) the duration of the very high frequency communications gap.]

[(Amdt. 125-25, Eff. 2/26/96)]

**§ 125.205 Equipment requirements:
 Airplanes under IFR.**

No person may operate an airplane under IFR unless it has—

- (a) A vertical speed indicator;
- (b) A free-air temperature indicator;
- (c) A heated pitot tube for each airspeed indicator;
- (d) A power failure warning device or vacuum indicator to show the power available for gyroscopic instruments from each power source;
- (e) An alternate source of static pressure for the altimeter and the airspeed and vertical speed indicators;
- (f) At least two generators each of which is on a separate engine, or which any combination of one-half of the total number are rated sufficiently to supply the electrical loads of all required instruments and equipment necessary for safe emergency operation of the airplane; and
- (g) Two independent sources of energy (with means of selecting either), of which at least one is an engine-driven pump or generator, each of which is able to drive all gyroscopic instruments and installed so that failure of one instrument or source does not interfere with the energy supply to the remaining instruments or the other energy source. For the purposes of this paragraph, each engine-driven source of energy must be on a different engine.
- (h) For the purposes of paragraph (f) of this section, a continuous inflight electrical load includes one that draws current continuously during flight, such as radio equipment, electrically driven instruments, and lights, but does not include occasional intermittent loads.

direct rays are shielded from the flight crewmembers' eyes and that no objectionable reflections are visible to them. There must be a means of controlling the intensity of illumination unless it is shown that nondimming instrument lights are satisfactory.

125.206 Pitot heat indication systems.

(a) Except as provided in paragraph (b) of this section, after April 12, 1981, no person may operate a transport category airplane equipped with a flight instrument pitot heating system unless the airplane is equipped with an operable pitot indication system that complies with § 25.1326 of this chapter in effect on April 12, 1978.

(b) A certificate holder may obtain an extension of the April 12, 1981, compliance date specified in paragraph (a) of this section, but not beyond April 12, 1983, from the Director, Flight Standards Service if the certificate holder—

- (1) Shows that due to circumstances beyond its control it cannot comply by the specified compliance date; and
 - (2) Submits by the specified compliance date a schedule for compliance acceptable to the Director, indicating that compliance will be achieved at the earliest practicable date.
- (Amdt. 125-3, Eff. 9/30/81); (Amdt. 125-13, Eff. 10/25/89)

**§ 125.207 Emergency equipment
 requirements.**

(a) No person may operate an airplane having a seating capacity of 20 or more passengers unless it is equipped with the following emergency equipment:

- (1) One approved first aid for treatment of injuries likely to occur in flight or in a minor accident, which meets the following specifications and requirements:
 - (i) Each first aid kit must be dust and moisture proof and contain only materials that either meet Federal Specifications GGK-391a, as revised, or as approved by the Administrator.

| | |
|---|---------|
| 【Adhesive bandage compressors, 1 in | 16 |
| Antiseptic swabs | 20 |
| Ammonia inhalants | 10 |
| Bandage compressors, 4 in | 8 |
| Triangular bandage compressors, 40 in | 5 |
| Arm splint, noninflatable | 1 |
| Leg splint, noninflatable | 1 |
| Roller bandage, 4 in | 4 |
| Adhesive tape, 1-in standard roll | 2 |
| Bandage scissors | 1 |
| Protective latex gloves or equivalent nonpermeable gloves | 1 pair】 |

【(iv) Protective latex gloves or equivalent nonpermeable gloves may be placed in the first aid kit or in a location that is readily accessible to crewmembers.】

(2) A crash axe carrier has to be accessible to the crew but inaccessible to passengers during normal operations.

(3) Signs that are visible to all occupants to notify them when smoking is prohibited and when safety belts should be fastened. The signs must be so constructed that they can be turned on and off by a crewmember. They must be turned on for each takeoff and each landing and when otherwise considered to be necessary by the pilot in command.

(4) The additional emergency equipment specified in appendix A of this part.

(b) *Megaphones*. Each passenger-carrying airplane must have a portable battery-powered megaphone or megaphones readily accessible to the crewmembers assigned to direct emergency evacuation, installed as follows:

(1) One megaphone on each airplane with a seating capacity of more than 60 and less than 100 passengers, at the most rearward location in the passenger cabin where it would be readily accessible to a normal flight attendant seat. However, the Administrator may grant a deviation from the requirements of this subparagraph if the Administrator finds that a different location would be more useful for evacuation of persons during an emergency.

on each airplane with a seating capacity of more than 199 passengers, one installed at the forward end, one installed at the most rearward location where it would be readily accessible to a normal flight attendant seat, and one installed in a readily accessible location in the mid-section of the airplane.

(Amdt. 125-19, Eff. 1/12/94); [(Amdt. 125-22, Eff. 12/2/94)]

§ 125.209 Emergency equipment: Extended overwater operations.

(a) No person may operate an airplane in extended overwater operations unless it carries, installed in conspicuously marked locations easily accessible to the occupants if a ditching occurs, the following equipment:

(1) An approved life preserver equipped with an approved survivor locator light, or an approved flotation means, for each occupant of the aircraft. The life preserver or other flotation means must be easily accessible to each seated occupant. If a flotation means other than a life preserver is used, it must be readily removable from the airplane.

(2) Enough approved life rafts (with proper buoyancy) to carry all occupants of the airplane, and at least the following equipment for each raft clearly marked for easy identification—

(i) One canopy (for sail, sunshade, or rain catcher);

(ii) One radar reflector (or similar device);

(iii) One life raft repair kit;

(iv) One bailing bucket;

(v) One signaling mirror;

(vi) One police whistle;

(vii) One raft knife;

(viii) One CO₂ bottle for emergency inflation;

(ix) One inflation pump;

(x) Two oars;

(xi) One 75-foot retaining line;

(xii) One magnetic compass;

(xiii) One dye marker;

(xvii) One sea water desalting kit for each two persons that raft is rated to carry, or two pints of water for each person the raft is rated to carry;

(xviii) One fishing kit; and

(xix) One book on survival appropriate for the area in which the airplane is operated.

(b) [No person may operate an airplane in extended overwater operations unless there is attached to one of the life rafts required by paragraph (a) of this section, an approved survival type emergency locator transmitter. Batteries used in this transmitter must be replaced (or recharged, if the batteries are rechargeable) when the transmitter has been in use for more than one cumulative hour, or, when 50 percent of their useful life (or for rechargeable batteries, 50 percent of their useful life of charge) has expired, as established by the transmitter manufacturer under its approval. The new expiration date for replacing (or recharging) the battery must be legibly marked on the outside of the transmitter. The battery useful life (or useful life of charge) requirements of this paragraph do not apply to batteries (such as water-activated batteries) that are essentially unaffected during probable storage intervals.]

[(Amdt. 125-20, Eff. 6/21/94)]

§ 125.211 Seats and safety belts.

(a) No person may operate an airplane unless there are available during the takeoff, en route flight, and landing—

(1) An approved seat or berth for each person on board the airplane who is at least 2 years old; and

(2) An approved safety belt for separate use by each person on board the airplane who is at least 2 years old, except that two persons occupying a berth may share one approved safety belt and two persons occupying a multiple lounge and divan seat may share one approved safety belt during en route flight only.

(b) Except as provided in paragraphs (b)(1) and (b)(2) of this section, each person on board an airplane operated under this part shall occupy an approved seat or berth with a separate safety belt properly secured about the surface, takeoff, and

has not reached his or her second birthday and the child does not occupy or use any restraining device; or]

(2) Notwithstanding any other requirement of this chapter, occupy an approved child restraint system furnished by the certificate holder or one of the persons described in paragraph (b)(2)(i) of this section, provided:

(i) The child is accompanied by a parent, guardian, or attendant designated by the child's parent or guardian to attend to the safety of the child during the flight;

(ii) [Except as provided in paragraph (b)(2)(ii)(D) of this section, the approved child restraint system bears one or more labels as follows:]

(A) Seats manufactured to U.S. standards between January 1, 1981, and February 25, 1985, must bear the label: "This child restraint system conforms to all applicable Federal motor vehicle safety standards."

(B) Seats manufactured to U.S. standards on or after February 26, 1985, must bear two labels:

(1) "This child restraint system conforms to all applicable Federal motor vehicle safety standards", and

(2) "THIS RESTRAINT IS CERTIFIED FOR USE IN MOTOR VEHICLES AND AIRCRAFT" in red lettering;

(C) Seats that do not qualify under paragraphs (b)(2)(ii)(A) and (b)(2)(ii)(B) of this section must bear either a label showing approval of a foreign government or a label showing that the seat was manufactured under the standards of the United Nations;

[(D) Notwithstanding any other provisions of this section, booster-type child restraint systems (as defined in Federal Motor Vehicle Standard No. 213 (49 CFR 571.213)), vest- and harness-type child restraint systems, and lap held child restraints are not approved for use in aircraft; and]

(iii) The certificate holder complies with the following requirements:

(C) The restraint system must bear the appropriate label(s).

(c) [Except as provided in paragraph (c)(3), the following prohibitions apply to certificate holders:

[(1) No certificate holder may permit a child, in an aircraft, to occupy a booster-type child restraint system, a vest-type child restraint system, a harness-type child restraint system, or a lap held child restraint system during take off, landing, and movement on the surface.

[(2) Except as required in paragraph (c)(1) of this section, no certificate holder may prohibit a child, if requested by the child's parent, guardian, or designated attendant, from occupying a child restraint system furnished by the child's parent, guardian, or designated attendant provided:

[(i) The child holds a ticket for an approved seat or berth or such seat or berth is otherwise made available by the certificate holder for the child's use;

[(ii) The requirements of paragraph (b)(2)(i) are met;

[(iii) The requirements (b)(2)(iii) are met; and

[(iv) The child restraint system has one or more of the labels described in paragraph (b)(2)(ii)(A) through paragraph (b)(2)(ii)(C).

[(3) This section does not prohibit the certificate holder from providing child restraint systems authorized by this section or, consistent with safe operating practices, determining the most appropriate passenger seat location for the child restraint system.]

(d) Each sideward facing seat must comply with the applicable requirements of § 25.785(c) of this chapter.

(e) No certificate holder may take off or land an airplane unless each passenger seat is in the upright position. Each passenger shall comply with instructions given by a crewmember in compliance with this paragraph. This paragraph does not apply to seats on which cargo or persons who are unable to sit erect for a medical reason are carried in accordance with procedures in the certificate holder's manual if the seat back does not obstruct any

required duties with the shoulder harness fastened. (Amdt. 125-17, Eff. 10/15/92); [(Amdt. 125-26, Eff. 9/3/96)]

§ 125.213 Miscellaneous equipment.

No person may conduct any operation unless the following equipment is installed in the airplane.

(a) If protective fuses are installed on an airplane, the number of spare fuses approved for the airplane and appropriately described in the certificate holder's manual.

(b) A windshield wiper or equivalent for each pilot station.

(c) A power supply and distribution system that meets the requirements of §§ 25.1309, 25.1331, 25.1351 (a) and (b)(1) through (4), 25.1353, 25.1355, and 25.1431(b) or that is able to produce and distribute the load for the required instruments and equipment, with use of an external power supply if any one power source or component of the power distribution system fails. The use of common elements in the system may be approved if the Administrator finds that they are designed to be reasonably protected against malfunctioning. Engine-driven sources of energy, when used, must be on separate engines.

(d) A means for indicating the adequacy of the power being supplied to required flight instruments.

(e) Two independent static pressure systems, vented to the outside atmospheric pressure so that they will be least affected by air flow variation or moisture or other foreign matter, and installed so as to be airtight except for the vent. When a means is provided for transferring an instrument from its primary operating system to an alternative system, the means must include a positive positioning control and must be marked to indicate clearly which system is being used.

(f) A placard on each door that is the means of access to a required passenger emergency exit to indicate that it must be open during takeoff and landing.

(g) A means for the crew, in an emergency, to unlock each door that leads to a compartment that is normally accessible to passengers and that can be locked by passengers.

(2) An emergency cockpit checklist containing the procedures required by paragraph (c) of this section, as appropriate.

(3) Pertinent aeronautical charts.

(4) For IFR operations, each pertinent navigational en route, terminal area, and approach and letdown chart;

(5) One—engine-inoperative climb performance data and, if the airplane is approved for use in IFR or over-the-top operations, that data must be sufficient to enable the pilot to determine that the airplane is capable of carrying passengers over-the-top or in IFR conditions at a weight that will allow it to climb, with the critical engine inoperative, at least 50 feet a minute when operating at the MEA's of the route to be flown or 5,000 feet a minute when operating at the MEA's of the route to be flown or 5,000 feet MSL, whichever is higher.

(b) Each cockpit checklist required by paragraph (a)(1) of this section must contain the following procedures: (1) Before starting engines; (2) Before takeoff; (3) Cruise; (4) Before landing, (5) After landing; (6) Stopping engines.

(c) Each emergency cockpit checklist required by paragraph (a)(2) of this section must contain the following procedures, as appropriate:

(1) Emergency operation of fuel, hydraulic, electrical, and mechanical systems.

(2) Emergency operation of instruments and controls.

(3) Engine inoperative procedures.

(4) Any other emergency procedures necessary for safety.

§ 125.217 Passenger information.

(a) [Except as provided in paragraph (b) of this section, no person may operate an airplane carrying passengers unless it is equipped with signs that meet the requirements of § 25.791 of this chapter and that are visible to passengers and flight attendants to notify them when smoking is prohibited and when safety belts must be fastened. The signs must be so constructed that the crew can turn them on and off. They must be turned on during airplane movement on the surface, for each takeoff, for each

occupy a seat or berth shall fasten his or her safety belt about him or her and keep it fastened while any "Fasten Seat Belt" sign is lighted.]

[(d) Each passenger shall comply with instructions given him or her by crewmembers regarding compliance with paragraphs (b) and (c) of this section.]

[(Amtd. 125-17, Eff. 10/15/92)]

§ 125.219 Oxygen for medical use by passengers.

(a) Except as provided in paragraphs (d) and (e) of this section, no certificate holder may allow the carriage or operation of equipment for the storage, generation or dispensing of medical oxygen unless the unit to be carried is constructed so that all valves, fittings, and gauges are protected from damage during that carriage or operation and unless the following conditions are met:

(1) The equipment must be—

(i) Of an approved type or in conformity with the manufacturing, packaging, marking, labeling, and maintenance requirements of Title 49 CFR parts 171, 172, and 173, except § 173.24(a)(1);

(ii) When owned by the certificate holder, maintained under the certificate holder's approved maintenance program;

(iii) Free of flammable contaminants on all exterior surfaces; and

(iv) Appropriately secured.

(2) When the oxygen is stored in the form of a liquid, the equipment must have been under the certificate holder's approved maintenance program since its purchase new or since the storage container was last purged.

(3) When the oxygen is stored in the form of a compressed gas as defined in Title 49 CFR § 173.300(a)—

(i) When owned by the certificate holder, it must be maintained under its approved maintenance program; and

(ii) The pressure in any oxygen cylinder must not exceed the rated cylinder pressure.

(b) When oxygen is being used, no person may smoke and no certificate holder may allow any person to smoke within 10 feet of oxygen storage and dispensing equipment carried under paragraph (a) of this section.

(c) No certificate holder may allow any person other than a person trained in the use of medical oxygen equipment to connect or disconnect oxygen bottles or any other ancillary component while any passenger is aboard the airplane.

(d) Paragraph (a)(1)(i) of this section does not apply when that equipment is furnished by a professional or medical emergency service for use on board an airplane in a medical emergency when no other practical means of transportation (including any other properly equipped certificate holder) is reasonably available and the person carried under the medical emergency is accompanied by a person trained in the use of medical oxygen.

(e) Each certificate holder who, under the authority of paragraph (d) of this section, deviates from paragraph (a)(1)(i) of this section under a medical emergency shall, within 10 days, excluding Saturdays, Sundays, and Federal holidays, after the deviation, send to the FAA Flight Standards district office charged with the overall inspection of the certificate holder a complete report of the operation involved, including a description of the deviation and the reasons for it.

§ 125.221 Icing conditions: Operating limitations.

(a) [No pilot may take off an airplane that has frost, ice, or snow adhering to any propeller, windshield, wing, stabilizing or control surface, to a powerplant installation, or to an airspeed, altimeter, rate of climb, or flight attitude instrument system, except under the follow conditions:

[(1) Takeoffs may be made with frost adhering to the wings, or stabilizing or control surfaces, if the frost has been polished to make it smooth.

[(2) Takeoffs may be made with frost under the wing in the area of the fuel tanks if authorized by the Administrator.

[(b) No certificate holder may authorize an airplane to take off and no pilot may take off an

airplane type, has been completed within 5 minutes prior to beginning takeoff. A pretakeoff contamination check is a check to make sure the wings and control surfaces are free of frost, ice, or snow.

[(2) The certificate holder has an approved alternative procedure and under that procedure the airplane is determined to be free of frost, ice, or snow.

[(3) The certificate holder has an approved deicing/anti-icing program that complies with § 121.629(c) of this chapter and the takeoff complies with that program.]

[(c)] Except for an airplane that has ice protection provisions that meet appendix C of this part or those for transport category airplane type certification, no pilot may fly—

(1) Under IFR into known or forecast light or moderate icing conditions; or

(2) Under VFR into known light or moderate icing conditions, unless the airplane has functioning deicing or anti-icing equipment protecting each propeller, windshield, wing, stabilizing or control surface, and each airspeed, altimeter, rate of climb, or flight attitude instrument system.

[(d)] Except for an airplane that has ice protection provisions that meet appendix C of this part or those for transport category airplane type certification, no pilot may fly an airplane into known or forecast severe icing conditions.

[(e)] If current weather reports and briefing information relied upon by the pilot in command indicate that the forecast icing condition that would otherwise prohibit the flight will not be encountered during the flight because of changed weather conditions since the forecast, the restrictions in paragraphs [(c) and (d)] of this section based on forecast conditions do not apply.

[(Amdt. 125-18, Eff. 1/31/94)]

§ 125.223 Airborne weather radar equipment requirements.

(a) No person may operate an airplane governed by this part in passenger-carrying operations unless approved airborne weather radar equipment is installed in the airplane.

required by paragraph (a) of this section is in satisfactory operating condition.

(c) If the airborne weather radar equipment becomes inoperative en route, the airplane must be operated under the instructions and procedures specified for that event in the manual required by § 125.71.

(d) This section does not apply to airplanes used solely within the State of Hawaii, within the State of Alaska, within that part of Canada west of longitude 130 degrees W, between latitude 70 degrees N, and latitude 53 degrees N, or during any training, test, or ferry flight.

(e) Without regard to any other provision of this part, an alternate electrical power supply is not required for airborne weather radar equipment.

§ 125.224 Traffic alert and collision avoidance system.

(a) After December 30, 1993, no person may operate a large airplane that has passenger seating configuration, excluding any pilot seat, or more than 30 seats unless it is equipped with an approved TCAS II traffic alert and collision avoidance system and the appropriate class of Mode S transponder.

(b) The manual required by § 125.71 of this part shall contain the following information on the TCAS II system required by this section.

(1) Appropriate procedures for—

(i) The operation of the equipment; and

(ii) Proper flightcrew action with respect to the equipment.

(2) An outline of all input sources that must be operating for the TCAS II to function properly.

Docket No. 25355 (54 FR 951) Eff. 1/10/89, (Amdt. 125-11, Eff. 2/9/89); (Amdt. 125-14, Eff. 5/9/90)

§ 125.225 Flight recorders.

(a) Except as provided in paragraph (d) of this section, after October 11, 1991, no person may operate a large airplane type certificated before October 1, 1969, for operations above 25,000 feet altitude, nor a multiengine, turbine-powered airplane type certificated before October 1, 1969, unless it is equipped with one or more approved

- (1) Time;
- (2) Altitude;
- (3) Airspeed;
- (4) Vertical acceleration;
- (5) Heading;
- (6) Time of each radio transmission to or from air traffic control;
- (7) Pitch attitude;
- (8) Roll attitude;
- (9) Longitudinal acceleration;
- (10) Control column or pitch control surface position; and
- (11) Thrust of each engine.

(b) Except as provided in paragraph (d) of this section, after October 11, 1991, no person may operate a large airplane type certificated after September 30, 1969, for operations above 25,000 feet altitude, nor a multiengine, turbine-powered airplane type certificated after September 30, 1969, unless it is equipped with one or more approved flight recorders that utilize a digital method of recording and storing data and a method of readily retrieving that data from the storage medium. The following information must be able to be determined within the ranges, accuracies, resolutions, and recording intervals specified in appendix D of this part:

- (1) Time;
- (2) Altitude;
- (3) Airspeed;
- (4) Vertical acceleration;
- (5) Heading;
- (6) Time of each radio transmission either to or from air traffic control;
- (7) Pitch attitude;
- (8) Roll attitude;
- (9) Longitudinal acceleration;
- (10) Pitch trim position;
- (11) Control column or pitch control surface position;
- (12) Control wheel or lateral control surface position;
- (13) Rudder pedal or yaw control surface position;
- (14) Thrust of each engine;
- (15) Position of each thrust reverser;

unit (DFAO) or equivalent unless it is equipped with one or more approved flight recorders that utilize a digital method of recording and storing data and a method of readily retrieving that data from the storage medium. Any parameters specified in appendix D of this part that are available on the digital data bus must be recorded within the ranges, accuracies, resolution, and sampling intervals specified.

(d) No person may operate under this part an airplane that is manufactured after October 11, 1991, unless it is equipped with one or more approved flight recorders that utilize a digital method of recording and storing data and a method of readily retrieving that data from the storage medium. The parameters specified in appendix D of this part must be recorded within the ranges, accuracies, resolutions and sampling intervals specified. For the purpose of this section, "manufactured" means the point in time at which the airplane inspection acceptance records reflect that the airplane is complete and meets the FAA-approved type design data.

(e) Whenever a flight recorder required by this section is installed, it must be operated continuously from the instant the airplane begins the takeoff roll until it has completed the landing roll at an airport.

(f) Except as provided in paragraph (g) of this section, and except for recorded data erased as authorized in this paragraph, each certificate holder shall keep the recorded data prescribed in paragraph (a), (b), (c), or (d) of this section, as applicable, until the airplane has been operated for at least 25 hours of the operating time specified in § 125.227(a) of this chapter. A total of 1 hour of recorded data may be erased for the purpose of testing the flight recorder or the flight recorder system. Any erasure made in accordance with this paragraph must be of the oldest recorded data accumulated at the time of testing. Except as provided in paragraph (g) of this section, no record need be kept more than 60 days.

(g) In the event of an accident or occurrence that requires immediate notification of the National Transportation Safety Board under 49 CFR part 830 and that results in termination of the flight, the certificate holder shall remove the recording media from the airplane and keep the recorded data

unit (DFAO) or equivalent unless it is equipped with one or more approved flight recorders that utilize a digital method of recording and storing data and a method of readily retrieving that data from the storage medium. Any parameters specified in appendix D of this part that are available on the digital data bus must be recorded within the ranges, accuracies, resolution, and sampling intervals specified.

- (1) That are of the same type;
- (2) On which the flight recorder models and their installations are the same; and
- (3) On which there are no differences in the type design with respect to the installation of the first pilot's instruments associated with the flight recorder. The most recent instrument calibration, including the recording medium from which this calibration is derived, and the recorder correlation must be retained by the certificate holder.

(i) Each flight recorder required by this section that records the data specified in paragraphs (a), (b), (c), or (d) of this section must have an approved device to assist in locating that recorder under water.

Docket No. 25530 (53 FR 26148) Eff. 7/11/88, (Amdt. 125-10, Eff. 10/11/88)

[§ 125.226 Digital flight data recorders.

[(a) Except as provided in paragraph (1) of this section, no person may operate under this part a turbine-engine-powered transport category airplane unless it is equipped with one or more approved flight recorders that use a digital method of recording and storing data and a method of readily retrieving that data from the storage medium. The operational parameters required to be recorded by digital flight data recorders required by this section are as follows: the phrase "when an information source is installed" following a parameter indicates that recording of that parameter is not intended to require a change in installed equipment:

- (1) Time;
- (2) Pressure altitude;
- (3) Indicated airspeed;
- (4) Heading—primary flight crew reference (if selectable, record discrete, true or magnetic);
- (5) Normal acceleration (Vertical);
- (6) Pitch attitude;
- (7) Roll attitude;
- (8) Manual radio transmitter keying, or CVR/DFDR synchronization reference;

- (15) Primary pitch control surface position;
- (16) Primary lateral control surface position;
- (17) Primary yaw control surface position;
- (18) Lateral acceleration;
- (19) Pitch trim surface position or parameters of paragraph (a)(82) of this section if currently recorded;
- (20) Trailing edge flap or cockpit flap control selection (except when parameters of paragraph (a)(85) of this section apply);
- (21) Leading edge flap or cockpit flap control selection (except when parameters of paragraph (a)(86) of this section apply);
- (22) Each Thrust reverser position (or equivalent for propeller airplane);
- (23) Ground spoiler position or speed brake selection (except when parameters of paragraph (a)(87) of this section apply);
- (24) Outside or total air temperature;
- (25) Automatic Flight Control System (AFCS) modes and engagement status, including autothrottle;
- (26) Radio altitude (when an information source is installed);
- (27) Localizer deviation, MLS Azimuth;
- (28) Glideslope deviation, MLS Elevation;
- (29) Marker beacon passage;
- (30) Master warning;
- (31) Air/ground sensor (primary airplane system reference nose or main gear);
- (32) Angle of attack (when information source is installed);
- (33) Hydraulic pressure low (each system);
- (34) Ground speed (when an information source is installed);
- (35) Ground proximity warning system;
- (36) Landing gear position or landing gear cockpit control selection;
- (37) Drift angle (when an information source is installed);
- (38) Wind speed and direction (when an information source is installed);
- (39) Latitude and longitude (when an information source is installed);
- (40) Stick shaker/pusher (when an information source is installed);
- (45) DME 1 and 2 distances;
- (46) Nav 1 and 2 selected frequency;
- (47) Selected barometric setting (when an information source is installed);
- (48) Selected altitude (when an information source is installed);
- (49) Selected speed (when an information source is installed);
- (50) Selected mach (when an information source is installed);
- (51) Selected vertical speed (when an information source is installed);
- (52) Selected heading (when an information source is installed);
- (53) Selected flight path (when an information source is installed);
- (54) Selected decision height (when an information source is installed);
- (55) EFIS display format;
- (56) Multi-function/engine/alerts display format;
- (57) Thrust command (when an information source is installed);
- (58) Thrust target (when an information source is installed);
- (59) Fuel quantity in CG trim tank (when an information source is installed);
- (60) Primary Navigation System Reference;
- (61) Icing (when an information source is installed);
- (62) Engine warning each engine vibration (when an information source is installed);
- (63) Engine warning each engine over temp. (when an information source is installed);
- (64) Engine warning each engine oil pressure low (when an information source is installed);
- (65) Engine warning each engine over speed (when an information source is installed);
- (66) Yaw trim surface position;
- (67) Roll trim surface position;
- (68) Brake pressure (selected system);
- (69) Brake pedal application (left and right);
- (70) Yaw of sideslip angle (when an information source is installed);
- (71) Engine bleed valve position (when an information source is installed);

information source is installed);

(77) Hydraulic pressure (each system);

(78) Loss of cabin pressure;

(79) Computer failure;

(80) Heads-up display (when an information source is installed);

(81) Para-visual display (when an information source is installed);

(82) Cockpit trim control input position—pitch;

(83) Cockpit trim control input position—roll;

(84) Cockpit trim control input position—yaw;

(85) Trailing edge flap and cockpit flap control position;

(86) Leading edge flap and cockpit flap control position;

(87) Ground spoiler position and speed brake selection; and

(88) All cockpit flight control input forces (control wheel, control column, rudder pedal).

[(b) For all turbine-engine-powered transport category airplanes manufactured on or before October 11, 1991, by August 20, 2001—

(1) For airplanes not equipped as of July 16, 1996, with a flight data acquisition unit (FDAU), the parameters listed in paragraphs (a)(1) through (a)(18) of this section must be recorded within the ranges and accuracies specified in Appendix D of this part, and—

(i) For airplanes with more than two engines, the parameter described in paragraph (a)(18) is not required unless sufficient capacity is available on the existing recorder to record that parameter.

(ii) Parameters listed in paragraphs (a)(12) through (a)(17) each may be recorded from a single source.

(2) For airplanes that were equipped as of July 16, 1996, with a flight data acquisition unit (FDAU), the parameters listed in paragraphs (a)(1) through (a)(22) of this section must be recorded within the ranges, accuracies, and recording intervals specified in Appendix E of this part. Parameters listed in paragraphs (a)(12) through (a)(17) each may be recorded from a single source.

to major structural components.

[(c) For all turbine-engine-powered transport category airplanes manufactured on or before October 11, 1991—

(1) That were equipped as of July 16, 1996, with one or more digital data bus(es) and an ARINC 717 digital flight data acquisition unit (DFDAU) or equivalent, the parameters specified in paragraphs (a)(1) through (a)(22) of this section must be recorded within the ranges, accuracies, resolutions, and sampling intervals specified in Appendix E of this part by August 20, 2001. Parameters listed in paragraphs (a)(12) through (a)(14) each may be recorded from a single source.

(2) Commensurate with the capacity of the recording system (DFDAU or equivalent and the DFDR), all additional parameters for which information sources are installed and which are connected to the recording system must be recorded within the ranges, accuracies, resolutions, and sampling intervals specified in Appendix E of this part by August 20, 2001.

(3) That were subject to § 125.225(e) of this part, all conditions of § 125.225(c) must continue to be met until compliance with paragraph (c)(1) of this section is accomplished.

[(d) For all turbine-engine-powered transport category airplanes that were manufactured after October 11, 1991—

(1) The parameters listed in paragraphs (a)(1) through (a)(34) of this section must be recorded within the ranges, accuracies, resolutions, and recording intervals specified in Appendix E of this part by August 20, 2001. Parameters listed in paragraphs (a)(12) through (a)(14) each may be recorded from a single source.

(2) Commensurate with the capacity of the recording system, all additional parameters for which information sources are installed and which are connected to the recording system, must be recorded within the ranges, accuracies, resolutions, and sampling intervals specified in Appendix E of this part by August 20, 2001.

[(e) For all turbine-engine-powered transport category airplanes that are manufactured after August 18, 2000—

which information sources are installed and which are connected to the recording system, must be recorded within the ranges, accuracies, resolutions, and sampling intervals specified in Appendix E of this part.

[(f) For all turbine-engine-powered transport category airplanes that are manufactured after August 19, 2002, the parameters listed in paragraphs (a)(1) through (a)(88) of this section must be recorded within the ranges, accuracies, resolutions, and recording intervals specified in Appendix E of this part.

[(g) Whenever a flight data recorder required by this section is installed, it must be operated continuously from the instant the airplane begins its takeoff roll until it has completed its landing roll.

[(h) Except as provided in paragraph (i) of this section, and except for recorded data erased as authorized in this paragraph, each certificate holder shall keep the recorded data prescribed by this section, as appropriate, until the airplane has been operated for at least 25 hours of the operating time specified in § 121.359(a) of this part. A total of 1 hour of recorded data may be erased for the purpose of testing the flight recorder or the flight recorder system. Any erasure made in accordance with this paragraph must be of the oldest recorded data accumulated at the time of testing. Except as provided in paragraph (i) of this section, no record need be kept more than 60 days.

[(i) In the event of an accident or occurrence that requires immediate notification of the National Transportation Safety Board under 49 CFR 830 of its regulations and that results in termination of the flight, the certificate holder shall remove the recorder from the airplane and keep the recorder data prescribed by this section, as appropriate, for at least 60 days or for a longer period upon the request of the Board or the Administrator.

[(j) Each flight data recorder system required by this section must be installed in accordance with the requirements of § 25.1459(a), (b), (d), and (e) of this chapter. A correlation must be established between the values recorded by the flight data recorder and the corresponding values being measured. The correlation must contain a sufficient number of correlation points to accurately establish the

(1) That are of the same type;
(2) On which the flight recorder system and its installation are the same; and

(3) On which there is no difference in the type design with respect to the installation of those sensors associated with the flight data recorder system. Documentation sufficient to convert recorded data into the engineering units and discrete values specified in the applicable appendix must be maintained by the certificate holder.

[(k) Each flight data recorder required by this section must have an approved device to assist in locating that recorder under water.

[(l) The following airplanes that were manufactured before August 18, 1997 need not comply with this section, but must continue to comply with applicable paragraphs of § 125.225 of this chapter, as appropriate:

(1) Airplanes that meet the Stage 2 noise levels of part 36 of this chapter and are subject to § 91.801(c) of this chapter, until January 1, 2000. On and after January 1, 2000, any Stage 2 airplane otherwise allowed to be operated under part 91 of this chapter must comply with the applicable flight data recorder requirements of this section for that airplane.

(2) General Dynamics Convair 580, General Dynamics Convair 600, General Dynamics Convair 640, deHavilland Aircraft Company Ltd. DHC-7, Fairchild Industries FH 227, Fokker F-27 (except Mark 50), F-28 Mark 1000 and Mark 4000, Gulfstream Aerospace G-159, Lockheed Aircraft Corporation Electra 10-A, Lockheed Aircraft Corporation Electra 10-B, Lockheed Aircraft Corporation Electra 10-E, Lockheed Aircraft Corporation L-188, Maryland Air Industries, Inc. F27, Mitsubishi Heavy Industries, Ltd. YS-11, Short Bros. Limited SD3-30, Short Bros. Limited SD3-60.]

[(Amdt. 125-30, 8/18/97)]

§ 125.227 Cockpit voice recorders.

(a) No certificate holder may operate a large turbine-engine-powered airplane or a large pressurized airplane with four reciprocating engines unless an approved cockpit voice recorder is installed in that airplane and is operated continuously from the

paragraph (a) of this section he intends to discontinue using before the prescribed dates.

(c) The cockpit voice recorder required by this section must also meet the following standards:

(1) The requirements of part 25 of this chapter in effect after October 11, 1991.

(2) After September 1, 1980, each recorder container must—

(i) Be either bright orange or bright yellow;

(ii) Have reflective tape affixed to the external surface to facilitate its location under water; and

(iii) Have an approved underwater locating device on or adjacent to the container which is secured in such a manner that it is not likely to be separated during crash impact, unless the cockpit voice recorder and the flight recorder, required by § 125.225 of this chapter, are installed adjacent to each other in such a manner that they are not likely to be separated during crash impact.

(d) In complying with this section, an approved cockpit voice recorder having an erasure feature

required to use the boom microphone below 18,000 feet mean sea level. No person may operate a large turbine-engine-powered airplane or a large pressurized airplane with four reciprocating engines manufactured after October 11, 1991, or on which a cockpit voice recorder has been installed to record the uninterrupted audio signal received by a boom or mask microphone in accordance with § 25.1457(c)(5) of this chapter.

(f) In the event of an accident or occurrence requiring immediate notification of the National Transportation Safety Board under 49 CFR part 830 of its regulations, which results in the termination of the flight, the certificate holder shall keep the recorded information for at least 60 days or, if requested by the Administrator or the Board, for a longer period. Information obtained from the record is used to assist in determining the cause of accidents or occurrences in connection with investigations under 49 CFR part 830. The Administrator does not use the record in any civil penalty or certificate action.

Docket No. 25530 (53 FR 26148) Eff. 7/11/88, (Amdt. 125-10, Eff. 10/11/88)

■ The recorded values must meet the designated range, resolution, and accuracy requirements during dynamic and static conditions. All data recorded must be correlated in time to within one second.

| <i>Parameters</i> | <i>Range</i> | <i>Accuracy (sensor input)</i> | <i>Seconds per sampling interval</i> | <i>Resolution</i> | <i>Remarks</i> |
|---|--|--|---|-------------------|---|
| 1. Time or Relative Time Counts | 24 Hrs, 0 to 4095 | +/- 0.125% Per Hour | 4 | 1 sec | UTC time preferred when available. Counter increments each 4 seconds of system operation. |
| 2. Pressure Altitude | - 1000 ft to max certificated altitude of aircraft. +5000 ft | +/- 100 to +/- 700 ft (see table, TSO C124a or TSO C51a) | 1 | 5' to 35' | Data should be obtained from the air data computer when practicable. |
| 3. Indicated airspeed or Calibrated air-speed | 50 KIAS or minimum value to Max V_{SO} , and V_{SO} to 1.2 V_D | +/- 5% and +/- 3% | 1 | 1 kt. | Data should be obtained from the air data computer when practicable. |
| 4. Heading (Primary flight crew reference) | 0-360° and Discrete "true" or "mag" | +/- 2° | 1 | 0.5° | When true or magnetic heading can be selected as the primary heading reference, a discrete indicating selection must be recorded. |
| 5. Normal Acceleration (Vertical) | - 3g to +6g | +/- 1% of max range excluding datum error of +/- 5% | 0.125 | 0.004g. | |
| 6. Pitch Attitude | +/- 75° | +/- 2° | 1 or 0.25 for airplanes operated under § 125.226(f) | 0.5° | A sampling rate of 0.25 is recommended. |
| 7. Roll Attitude | +/- 180° | +/- 2° | 1 or 0.5 for airplanes operated under § 125.226(f) | 0.5° | A sampling rate of 0.5 is recommended. |

| | | | | | |
|--|------------------------|---|---|--------------------|--|
| chronization reference | | | | | provided the system complies with TSO C124a CVR synchronization requirements (paragraph 4.2.1 ED-55). |
| 9. Thrust/Power on Each Engine—primary flight crew reference | Full Range Forward | +/- 2% | 1 (per engine) | 0.2% of full range | Sufficient parameters (e.g. EPR, N1 or Torque, NP) as appropriate to the particular engine be recorded to determine power in forward and reverse thrust, including potential overspeed conditions. |
| 10. Autopilot Engagement | Discrete “on” or “off” | | 1 | | |
| 11. Longitudinal Acceleration | +/- 1g | +/- 1.5% max. range excluding datum error of +/- 5% | 0.25 | 0.004g. | |
| 12a. Pitch Control(s) position (non-fly-by-wire systems) | Full Range | +/- 2° Unless Higher Accuracy Uniquely Required | 0.5 or 0.25 for airplanes operated under § 125.226(f) | 0.2% of full range | For airplanes that have a flight control break away capability that allows either pilot to operate the controls independently, record both control inputs. The control inputs may be sampled alternately once per second to produce the sampling interval of 0.5 or 0.25, as applicable. |
| 12b. Pitch Control(s) position (fly-by-wire systems) | Full Range | +/- 2° Unless Higher Accuracy Uniquely Required | 0.5 or 0.25 for airplanes operated under § 125.226(f) | 0.2% of full range | |
| 13a. Lateral Control position(s) (non-fly-by-wire) | Full Range | +/- 2° Unless Higher Accuracy Uniquely Required | 0.5 or 0.25 for airplanes operated under § 125.226(f) | 0.2% of full range | For airplanes that have a flight control break away capability that allows either pilot to operate the controls independently, record both control inputs. The control inputs may be sampled alternately once per second to produce the sampling interval of 0.5 or 0.25, as applicable. |

| | | | | | |
|--|------------|---|---|--------------------|---|
| 14a. Yaw Control position(s) (non-fly-by-wire) | Full Range | +/- 2° Unless Higher Accuracy Uniquely Required | 0.5 | 0.2% of full range | For airplanes that have a flight control break away capability that allows either pilot to operate the controls independently, record both control inputs. The control inputs may be sampled alternately once per second to produce the sampling interval of 0.5. |
| 14b. Yaw Control position(s) (fly-by-wire) | Full Range | +/- 2° Unless Higher Accuracy Uniquely Required | 0.5 | 0.2% of full range | |
| 15. Pitch Control Surface(s) Position | Full Range | +/- 2° Unless Higher Accuracy Uniquely Required | 0.5 or 0.25 for airplanes operated under § 125.226(f) | 0.2% of full range | For airplanes fitted with multiple or split surfaces, a suitable combination of inputs is acceptable in lieu of recording each surface separately. The control surfaces may be sampled alternately to produce the sampling interval of 0.5 or 0.25. |
| 16. Lateral Control Surface(s) Position | Full Range | +/- 2° Unless Higher Accuracy Uniquely Required | 0.5 or 0.25 for airplanes operated under § 125.226(f) | 0.2% of full range | A suitable combination of surface position sensors is acceptable in lieu of recording each surface separately. The control surfaces may be sampled alternately to produce the sampling interval of 0.5 or 0.25. |
| 17. Yaw Control Surface(s) Position | Full Range | +/- 2° Unless Higher Accuracy Uniquely Required | 0.5 | 0.2% of full range | For airplanes with multiple or split surfaces, a suitable combination of surface position sensors is acceptable in lieu of recording each surface separately. The control surfaces may be sampled alternately to produce the sampling interval of 0.5. |
| 18. Lateral Acceleration | +/- 1g | +/- 1.5% max. range excluding datum error of +/- 5% | 0.25 | 0.004g. | |

| | | | | | |
|--|--|--|--|-----------------------|--|
| 20. Trailing Edge Flap or Cockpit Control Selection | Full Range or Each Position (discrete) | +/- 3° or as Pilot's indicator | 2 | 0.5% of full range | Flap position and cockpit control may each be sampled alternately at 4 second intervals, to give a data point every 2 seconds. |
| 21. Leading Edge Flap or Cockpit Control Selection | Full Range or Each Discrete Position | +/- 3° or as Pilot's indicator and sufficient to determine each discrete position. | 2 | 0.5% of full range | Left and right sides, or flap position and cockpit control may each be sampled at 4 second intervals, so as to give a data point every 2 seconds. |
| 22. Each Thrust Reverser Position (or equivalent for propeller airplane) | Stowed, In Transit, and Reverse (Discrete) | | 1 (per engine). | | Turbo-jet—2 discretes enable the 3 states to be determined. Turbo-prop—1 discrete. |
| 23. Ground Spoiler Position or Speed Brake Selection | Full Range or Each Position (discrete) | +/- 2° Unless Higher Accuracy Uniquely Required | 1 or 0.5 for airplanes operated under § 125.226(f) | 0.2% of full range | |
| 24. Outside Air Temperature or Total Air Temperature | -50°C to -90°C | +/- 2 °C | 2 | 0.3 °C. | |
| 25. Autopilot/ Autothrottle/AFCS Mode and Engagement Status | A suitable combination of discretes | | 1 | | Discretes should show which systems are engaged and which primary modes are controlling the flight path and speed of the aircraft. |
| 26. Radio Altitude | -20 ft to 2,500 ft | +/- 2 ft or +/- 3% Whichever is Greater Below 500 ft and +/- 5% Above 500 ft. | 1 | 1 ft +5% above 500 ft | For autoland/category 3 operations, each radio altimeter should be recorded, but arranged so that at least one is recorded each second. |
| 27. Localizer Deviation, MLS Azimuth, or GPS Lateral Deviation | +/- 400 Microamps or available sensor range as installed +/- 62° | As installed. +/- 3% recommended. | 1 | 0.3% of full range | For autoland/category 3 operations. each system should be recorded but arranged so that at least one is recorded each second. It is not necessary to record ILS and MLS at the same time, only the approach aid in use need be recorded. |

| | | | | | |
|---|---|---------------------------------|--|--------------------|---|
| | stalled. 0.9 to + 30° | | | | is recorded each second. It is not necessary to record ILS and MLS at the same time, only the approach aid in use need be recorded. |
| 29. Marker Beacon Passage | Discrete “on” or “off” | | 1 | | A single discrete is acceptable for all markers. |
| 30. Master Warning | Discrete | | 1 | | Record the master warning and record each ‘red’ warning that cannot be determined from other parameters or from the cockpit voice recorder. |
| 31. Air/ground sensor (primary airplane system reference nose or main gear) | Discrete “air” or “ground” | | 1 (0.25 recommended). | | |
| 32. Angle of Attack (If measured directly) | As installed | As Installed | 2 or 0.5 for airplanes operated under § 125.226(f) | 0.3% of full range | If left and right sensors are available, each may be recorded at 4 or 1 second intervals, as appropriate, so as to give a data point at 2 seconds or 0.5 second, as required. |
| 33. Hydraulic Pressure Low, Each System | Discrete or available sensor range, “low” or “normal” | +/- 5% | 2 | 0.5% of full range | |
| 34. Groundspeed | As Installed | Most Accurate Systems Installed | 1 | 0.2% of full range | |
| 35. GPWS (ground proximity warning system) | Discrete “warning” or “off” | | 1 | | A suitable combination of discretes unless recorder capacity is limited in which case a single discrete for all modes is acceptable. |
| 36. Landing Gear Position or Landing gear cockpit control selection | Discrete | | 4 | | A suitable combination of discretes should be recorded. |
| 37. Drift Angle | As installed | As installed | 4 | 0.1° | |

| | | | | | |
|---|-----------------------------|--------------|-------------------------|--------------------|---|
| Longitude | | | | installed | Navigation System Reference. Where capacity permits Latitude/longitude resolution should be 0.0002°. |
| 40. Stick shaker and pusher activation | Discrete(s) "on" or "off" | | 1 | | A suitable combination of discretes to determine activation. |
| 41. Windshear Detection | Discrete "warning" or "off" | | 1 | | |
| 42. Throttle/power lever position | Full Range | +/- 2% | 1 for each lever | 2% of full range | For airplanes with non-mechanically linked cockpit engine controls. |
| 43. Additional Engine Parameters | As installed | As installed | Each engine each second | 2% of full range | Where capacity permits, the preferred priority is indicated vibration level, N2, EGT, Fuel Flow, Fuel Cut-off lever position and N3, unless engine manufacturer recommends otherwise. |
| 44. Traffic Alert and Collision Avoidance System (TCAS) | Discretes | As installed | 1 | | A suitable combination of discretes should be recorded to determine the status of-Combined Control, Vertical Control, Up Advisory, and Down Advisory. (ref. ARINC Characteristic 735 Attachment 6E, TCAS VERTICAL RA DATA OUTPUT WORD.) |
| 45. DME 1 and 2 Distance | 0-200 NM | As installed | 4 | 1 NM | 1 mile. |
| 46. Nav 1 and 2 Selected Frequency | Full range | As installed | 4 | | Sufficient to determine selected frequency |
| 47. Selected barometric setting | Full range | +/- 5% | (1 per 64 sec.) | 0.2% of full range | |
| 48. Selected Altitude | Full range | +/- 5% | 1 | 100 ft. | |
| 49. Selected speed | Full range | +/- 5% | 1 | 1 knot | |
| 50. Selected Mach | Full range | +/- 5% | 1 | .01 | |
| 51. Selected vertical speed | Full range | +/- 5% | 1 | 100 ft/min. | |

| | | | | | |
|---|---|--------|-----------------|------------------|--|
| 54. Selected decision height | Full range | +/- 5% | 64 | 1 ft. | |
| 55. EFIS display format | Discrete(s) | | 4 | | Discretes should show the display system status (e.g., off, normal, fail, composite, sector, plan, nav aids, weather radar, range, copy). |
| 56. Multi-function/Engine Alerts Display format | Discrete(s) | | 4 | | Discretes should show the display system status (e.g., off, normal, fail, and the identity of display pages for emergency procedures, need not be recorded). |
| 57. Thrust command | Full range | +/- 2% | 2 | 2% of full range | |
| 58. Thrust target | Full range | +/- 2% | 4 | 2% of full range | |
| 59. Fuel quantity in CG trim tank | Full range | +/- 5% | (1 per 64 sec.) | 1% of full range | |
| 60. Primary Navigation System Reference | Discrete GPS, INS, VOR/DME, MLS, Loran C, Omega, Localizer Glideslope | | 4 | | A suitable combination of discrete to determine the Primary Navigation System reference. |
| 61. Ice Detection | Discrete "ice" or "no ice" | | 4 | | |
| 62. Engine warning each engine vibration | Discrete | | 1 | | |
| 63. Engine warning each engine over temp | Discrete | | 1 | | |
| 64. Engine warning each engine oil pressure low | Discrete | | 1 | | |
| 65. Engine warning each engine over speed | Discrete | | 1 | | |

| | | | | | |
|---|---------------------------------------|---|-----------------|--------------------|---|
| 67. Roll Trim Surface Position | Full Range | +/- 3% Unless Higher Accuracy Uniquely Required | 2 | 0.3% of full range | |
| 68. Brake Pressure (left and right) | As installed | +/- 5% | 1 | | To determine braking effort applied by pilots or by autobrakes. |
| 69. Brake Pedal Application (left and right) | Discrete or Analog "applied" or "off" | +/- 5% (Analog) | 1 | | To determine braking applied by pilots. |
| 70. Yaw or sideslip angle | Full Range | +/- 5% | 1 | 0.5° | |
| 71. Engine bleed valve position | Discrete "open" or "closed" | | 4 | | |
| 72. De-icing or anti-icing system selection | Discrete "on" or "off" | | 4 | | |
| 73. Computed center of gravity | Full Range | +/- 5% | (1 per 64 sec.) | 1% of full range | |
| 74. AC electrical bus status | Discrete "power" or "off" | | 4 | | Each bus. |
| 75. DC electrical bus status | Discrete "power" or "off" | | 4 | | Each bus. |
| 76. APU bleed valve position | Discrete "open" or "closed" | | 4 | | |
| 77. Hydraulic Pressure (each system) | Full range | +/- 5% | 2 | 100 psi. | |
| 78. Loss of cabin pressure | Discrete "loss" or "normal" | | 1 | | |
| 79. Computer failure (critical flight and engine control systems) | Discrete "fail" or "normal" | | 4 | | |

| | | | | | |
|---|------------------------------|--------|-----|--------------------|--|
| 81. Para-visual display (when an information source is installed) | Discrete(s) "on" or "off" | | 1 | | |
| 82. Cockpit trim control input position—pitch | Full Range | +/- 5% | 1 | 0.2% of full range | Where mechanical means for control inputs are not available, cockpit display trim positions should be recorded. |
| 83. Cockpit trim control input position—roll | Full Range | +/- 5% | 1 | 0.2% of full range | Where mechanical means for control inputs are not available, cockpit display trim positions should be recorded. |
| 84. Cockpit trim control input position—yaw | Full Range | +/- 5% | 1 | 0.2% of full range | Where mechanical means for control inputs are not available, cockpit display trim positions should be recorded. |
| 85. Trailing edge flap and cockpit flap control position | Full Range | +/- 5% | 2 | 0.5% of full range | Trailing edge flaps and cockpit flap control position may each be sampled alternately at 4 second intervals to provide a sample each 0.5 second. |
| 86. Leading edge flap and cockpit flap control position | Full Range or Discrete | +/- 5% | 1 | 0.5% of full range | |
| 87. Ground spoiler position and speed brake selection | Full Range or discrete | +/- 5% | 0.5 | 0.2% of full range | |

| | | | | | |
|--------|---|--|--|--|--|
| pedal) | umn ± 85 lbs Rudder pedal ± 165 lbs | | | | of the control input device only, it is not necessary to record this parameter. For airplanes that have a flight control break-away capability that allows either pilot to operate the control independently, record both control force inputs. The control force inputs may be sampled alternately once per 2 seconds to produce the sampling interval of 1.] |
|--------|---|--|--|--|--|

[(Amdt. 125-30, 8/18/97)]

